

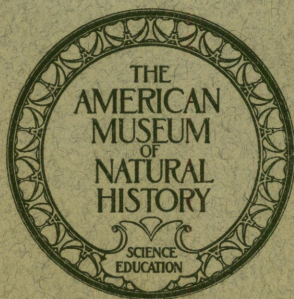
HORNED RUMINANTS

of NORTH AMERICA

BY CHILDS FRICK

103 TEXT FIGURES

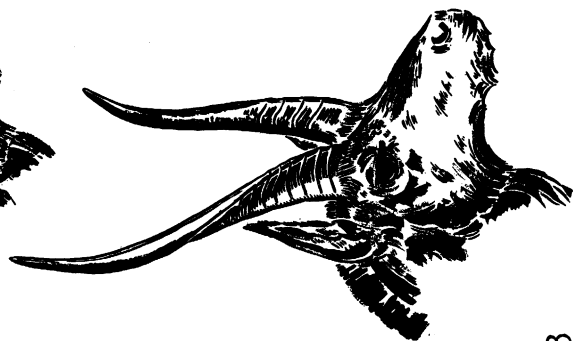
BULLETIN
OF
THE AMERICAN MUSEUM OF
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VOLUME LXIX, 1937



NEW YORK
March 31, 1937



A



B



E



C



D

FRONTISPIECE. Pronghorns and deer of the American Late Tertiary.
Reconstructions $\times$ approximately $\frac{1}{2}$ (A slightly oversize).

Merriam's Pronglet (A)

Merriamoceros coronatus (Merriam) (p. 332)

Osborn's Pronghorn (B)

Osbornoceros osborni, n.g. and sp. (p. 471)

Gregory's Deerlet (C)

Parablastomeryx gregorii, n.g. and sp. (p. 217)

Four-horned Deer (D)

Sinclairiomeryx sinclairi, n.g. and sp. (p. 147)

Three-horned Deer (E)

Procerantoceros skinneri, n.aug. and sp. (p. 75)

Further reconstructions, Figs. 1, 2D, 19, 27, 49, 55 and 59

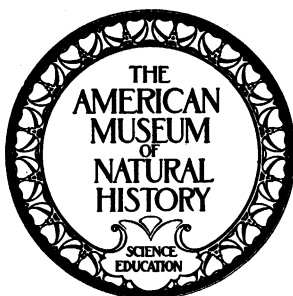
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FOREWORD

The horn-bearing ruminants of America of historic time—the deer, moose, wapiti and caribou, the mountain goat and sheep, and the pronghorn antelope and bison—have claimed the interest of many besides hunters and naturalists. In this volume are assembled the previously recorded and much new data as to the number, nature and affinities of certain of the widely diverse horned and antlered predecessors of these modern forms. Few in kind, the Recent species comprise a mere remnant of those diversified assemblages of horned and hornless ruminants which existed in America during that portion of the so-called “Age of Mammals” which embraced the Quaternary (Recent and glacio-Pleistocene) and the upper third (Pliocene, Miocene and Late Oligocene) of the immediately preceding and vastly longer Tertiary. The palæontologist’s data consist of remains retrieved from fortuitous burials of the past. The fossilized evidence of the present volume numbers over seven thousand specimens—skulls, partial skulls, jaws, horns and limbs. Though most of the modern horn-bearing forms have been identified from superficial accumulations of relatively recent glacial age, so far only the pronghorn and deer groups have been encountered in the indurated deposits of the older to vastly older Late and Middle Tertiary. In the deposits of glacial time the progenitors of certain of the creatures of today are occasionally encountered in association with peculiarly distinct though broadly allied creatures. The latest of such curious prehistoric forms, even if known in part to early man, must have been extinct long before the arrival of Columbus. In the earlier and far remote Tertiary, the ancestors of our American pronghorn and deer are still masked amid the host of widely diversified Antilocaprids and Cervids of the vanished faunas of that time. The magnificence of the mammalian assemblages of the American past is in strange contrast to the impoverishment of the Recent fauna. While the final disappearance of the rich herds of the Tertiary, of which the genera and species here glimpsed formed a part, may not be charged to the interference of man, the continuance of the surviving creatures of today rests with civilization. Doubtlessly foremost among factors contributing to the destruction of the great assemblages of Tertiary time were changes in topography and climate, accompanied by the shifting of faunas and the ravages of predatory hosts of both the animal and plant worlds.

The evidence described in the present volume represents a particular section of the accumulated collections of fifteen years of exploration of fossiliferous deposits in the states of New Mexico, Colorado, Nebraska, Kansas, Wyoming, Arizona, Texas, Oklahoma, Nevada and California, and in Alaska. It is hoped that these studies on the range of form in the horned ruminants of prehistoric America, in conjunction with the parallel investigations in progress on the extinct American Camelidæ, Oreodontidæ, Equidæ and Carnivora, by making available a wealth of new evidence, may establish a new starting point for the interpretation and tracing-out of the comings and goings of the mammals of the Late Tertiary-Quaternary and the reconstruction and filling-in of portions of the general biological and historical pattern. Knowledge as to the history of mammals and the correlation of faunas and formations is still limited by woeful lack of information as to the kinds, relationships and distribution of the vast multitude of extinct forms. The manner of origin of the individuals of the groups under discussion is yet unknown. Such origin may be found to have been parallel and largely similar for all mammals.

The writer's acknowledgments are due first to the leaders and members of the field parties cited in the ensuing pages in conjunction with the detailed lists of fossil remains, whose painstaking investigations have resulted in so vastly increasing the available data both as to the new and to previously described species. Prominent among these are Joseph Rak, John C. Blick, Charles H. Falkenbach, Morris F. Skinner, Jack Wilson, Ralph Mefferd, John Lynch, Carl Long, William Klaus, Ted Galusha, Peter Kaisen and their associates, and among Professor E. H. Barbour's assistants, C. Bertrand Schultz, Grayson Meade and F. W. Johnson. Sincere thanks are due to the collections' custodian, Floyd Blair, and to Joseph Rooney and associates for their skillful preparation of the material. Acknowledgment also is made to Haakon G. Dehlin for his aid in the details of many of the studies, especially in the inter-comparison of limb elements, preparation of measurement tables and filing of the data¹ for ready reference. Warm appreciation is expressed to Sydney E. Helprin for his assistance in the editing of the manuscript and in the carrying of this with frequent additions safely through the press. The writer is particularly indebted to Dr. William K. Gregory for his critical reading of the text in its original form.

The eight plates of reconstructions of the Tertiary Cervids, Antilocaprids, Protoceratids and Quaternary Antilocaprids and Bovids are by Joseph M. Guerry. The restoration of the deciduous "horn-sheaths" of

¹ The method of filing the fossil data is shown in the photograph of *Paracosoryx wilsoni* and *Merriamoceros coronatus* specimens, Figure 40A, page 371.

the Antilocapriini and "antlers" of the Aletomerycini-Dromomerycini are largely hypothetical as the same are in no case, so far, preserved. The ninety-three text figures of some six hundred and fifty-seven scaled drawings¹ of horns, crania, dentitions and limb elements have been executed by Hazel de Berard. These drawings are based on camera lucida and pantographic outlines, the specimens appearing in "orthogonal projection." Dimensions which are parallel to the plane of the drawing are in their true size, but dimensions which are at an angle with the plane are more or less foreshortened. (By referring to both the lateral and posterior views in the case of the Merycodontini horn drawings, for example, the true dimensions of a specimen may be readily obtained.) For the sake of uniformity and ease of comparison, elevations of the larger skulls and horns are figured at one-third actual size; the smaller skulls and horns and the great majority of mandibular rami at one-half actual size; the occlusal (and lateral) views of the teeth at natural size, and the limbs at one-half actual size.

The only deviation from these scales is in the case of the comparative unit drawings of crania, Fig. 2, and teeth, Figs. 2B, 67, and one figure of the Bovidae $\times \frac{1}{2}$.

All specimens are figured in the line drawings as left-hand, right-hand specimens being reversed so as to appear left. Such specimens are marked "rev." on the figures. The reconstructions of the heads in the flesh are approximately $\times \frac{1}{6}$, except the Merycodontini $\times \frac{1}{4}$ and the Pleistocene-Recent Cervini $\times \frac{1}{18}$.

The dentitions, horns and limbs have been filed for reference arranged on plaster plaques according to the order of their listing in this volume. For convenience, the material is divided between tentative size groups. The dentition size groups do not always synchronize with those of the limbs because of differences in the limb proportions of various genera and families. Tooth wear is indicated by symbols: A (adolescent), M (mature), W (worn), etc.

For the privilege of reproducing certain important types and other specimens of the literature, the author wishes to acknowledge his appreciation of the courtesy of:

Professor Henry Fairfield Osborn of the American Museum of Natural History, regarding the material described by Cope and Matthew, and the types of

Dromomeryx borealis (Cope, 1878),
Blastomeryx gemmifer Cope, 1874,
Cranioceras unicornis Matthew, 1918, and
Ramoceros (Merycodus) osborni (Matthew, 1904);

Doctor Charles W. Gilmore of the U. S. National Museum, in relation to the type of
Cranioceras (Dicrocerus) teres (Cope, 1874);

¹ Where more than one view of the same specimen (or specimens of one catalogue number) occur on the same plate, all are counted as one drawing; where appearing on different plates, they are separately counted. Cross sections are not counted. The six hundred and fifty-seven drawings are representative of five hundred and fifty-two different actual specimens (including sixteen hornless *Hypertragulids*).

Professor William J. Sinclair of Princeton University, the types of

Drepanomeryx falciformis Sinclair, 1915,
Dromomeryx whitfordi Sinclair, 1915, and
Dromomeryx antilopinus Scott, 1893;

Director Thomas Barbour of the Museum of Comparative Zoölogy, Harvard University, the type of

Aletomeryx (Blastomeryx) scottii (Matthew, 1924) and the *Cosoryx* remains of the Garman Collection, described by William B. Scott, 1890;

Director Andrey Avinoff of the Carnegie Museum of Pittsburgh, for the loan of the
Dromomeryx borealis (Cope, 1878), Douglass cotype, and other data;

Director Charles Cadwallader of the Academy of Natural Sciences of Philadelphia, for the use of the

"*Merycodus necatus*" remains from South Dakota, studied by Joseph Leidy, 1854;

Director J. D. Figgins of the Colorado Museum of Natural History, for the use of the type of

Yumaceras figginsi, n.g. and sp., and other remains;

Doctor Mark Francis of the Agricultural and Mechanical College of Texas, for the opportunity of describing

Prosynthetoceras francisi, n.subg. and sp.;

President Charles E. Bunnell of the University of Alaska in connection with the discoveries of the Alaska College-American Museum Expedition—

Cervalces alaskensis, n.sp.,
Saiga ricei, n.sp.,
Ovis dorshi, n.sp., and
Bos bunnelli, n.sp.;

Doctor Erwin H. Barbour of the Nebraska State Museum, for the privilege of studying the types of

Barbouromeryx trigonocorneus (Barbour and Schultz, 1934) and
Proantilocapra platycornea Barbour and Schultz, 1934.

The writer further would express his deep appreciation of the courtesy and kindly coöperation of Doctor Erwin H. Barbour in permitting the description and figuring in these pages of much unique and heretofore unpublished evidence from the unrivaled series of the Nebraska State University Collection.

C. F.

AMERICAN MUSEUM OF NATURAL HISTORY

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LIST OF INSTITUTIONS CITED AND ABBREVIATIONS USED

F:A.M.	Frick Collection (American Mammals or) American Museum of Natural History	Kans. Univ.	University of Kansas Museum
F:B:A.M.	Frick-Barbour, American Mammals	L.A.M.	Los Angeles Museum
A.C.-F:A.M.	Alaska College ¹ -Frick, American Museum of Natural History	Marshall Coll.	Dr. C. E. Marshall, Livingston, Montana
A.M.	American Museum of Natural History	M.C.Z.	Museum of Comparative Zoology, Harvard University
" (M.)	" " (Dept. of Mammalogy)	N.M.	U. S. National Museum
		" Biol. Surv.	" " " Biological Survey Collection
Amh. Coll.	Amherst College	N.S.M.	Nebraska State Museum
A.N.S.P.	Academy of Natural Sciences of Philadelphia	P.U.	Princeton University
Brit. Mus.	British Museum (Natural History)	Royal Ontario Mus.	Royal Ontario Museum of Zoology
C.I.T.	California Institute of Technology	Stanford Univ.	Stanford University
Can. Geol. Surv.	Geological Survey, Dept. of Mines, Canada	T.A.M.C. [College Station, Mark Francis Collection]	Texas Agricultural and Mechanical College
C.M.	Carnegie Museum of Pittsburgh	Univ. Ariz.	University of Arizona Museum
Col. M.	Colorado Museum of Natural History	U.C. or U.C.-"M"	University of California Museum of Paleontology
Geol. Mus., Ottawa, Canada	Geological Museum, University of Ottawa, Canada	Univ. Iowa	University of Iowa
H.C.	Harold Cook Collection, Agate, Nebraska	Univ. Pa.	University of Pennsylvania
H.C.-A.M.	Harold Cook: American Museum of Natural History	Univ. Toronto	University of Toronto
		Y.P.M.	Yale University, Peabody Museum of Natural History

¹Now Alaska University.

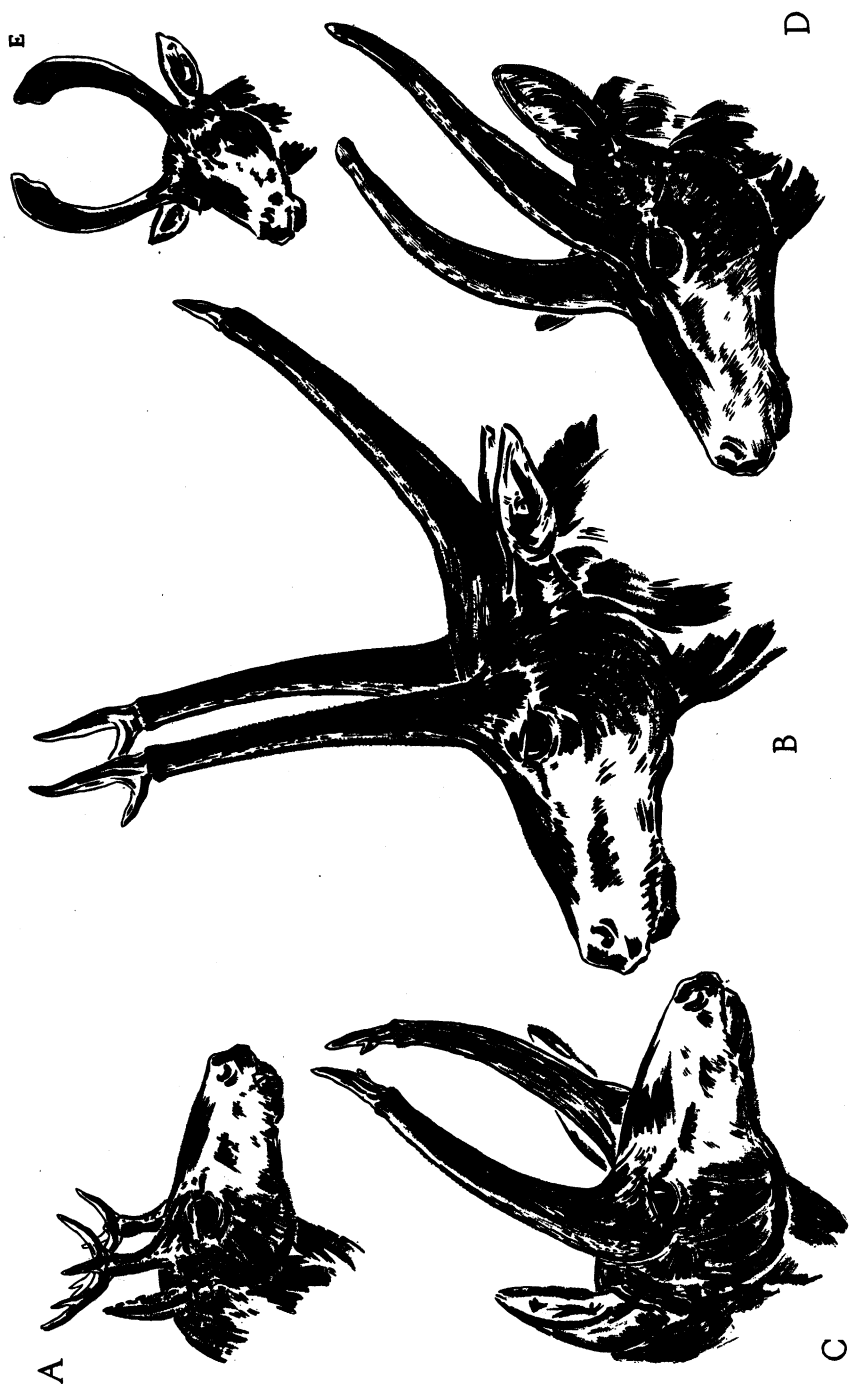


Fig. 1. Deer forms of the American Tertiary.

Reconstructions $\times$ approximately $\frac{1}{2}$ (except B, slightly oversize, and E $\times \frac{1}{12}$).

Lull's Deerlet (A)
Aldomerus gracilis Lull (p. 147)

Douglass' Deer (C)
Dromomeryx whitfordi Sinclair (p. 109)

Three-horned Deer (B)
Cratoceras granti, n.sp. (p. 75)

Sinclair's Deer (E)
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HORNED RUMINANTS

of NORTH AMERICA

INTRODUCTION

The variously specialized deer, pronghorns and protoceratines of the Tertiary, and deer, pronghorns, aberrant-antelope, sheep and bison of the Quaternary, represent so many forerunners of the surviving horned and antlered creatures of America of today. The present volume describes a large number of heretofore unknown members of these several American Tertiary and Quaternary groups and presents a tentative reclassification of the whole, together with a catalogue of the available fossil remains.

The Cervidæ, Antilocapridæ, Bovidæ and Protoceratidæ include in their membership all of the American horned as contrasted to hornless Ruminantia, such as the Hypertragulidæ, Camelidæ and Oreodontidæ. The diminutive Antilocaprid Merycodontini afford the richest known record of actual variations occurring within bands of horned mammals of closely related species over a wide geologic and geographic range. The presence of horns permits a much more detailed division of the material of this report between genera and subgenera than would be possible had the classification to be restricted to the usual slightly marked characters in hornless groups of skull, dentition and limbs. Much unexpected evidence as to the kinds, characters and affinities of these ancestral Rumi-

nantia, particularly of the Cervidæ and Antilocapridæ, has been one of the results of the intensive investigation during the past fifteen years of western Tertiary deposits. Well may one ponder the rule of nature responsible for so many and such curiously diversified forms.

There are enumerated in the present volume a total of seventy-one¹ North American genera and subgenera (forty-nine genera from the Tertiary and twenty-two from the Pleistocene-Recent²) of the five families, Cervidæ, Antilocapridæ, Bovidæ, Protoceratidæ and (hornless) Hypertragulidæ. Twenty-nine of the Tertiary and two of the Pleistocene genera and subgenera are new. Of the one hundred and seventy geologic and geographic species and subspecies, ninety-five are new. (Incidental to the discussion of these forms, two curious new genera are described under the Camelidæ for the purpose of comparison in the Appendix—Chapter VI).

The preliminary classification (p. 31) of the American Tertiary and Quaternary deer and pronghorns, census of the known forms and catalogue of the now available evidence (past and present) afford a glimpse of the range of morphologic characters in several distinct groups and the degree of variation within the individual, and are interesting in connection with hypotheses as to the origins and affinities of the living forms. The classification permits of an orderly presentation and arrangement of the present data and may aid in the identification of unlisted remains in other institutions and the assimilation of the evidence yet to come.

The difficulty of securing a balanced arrangement, inasmuch as one division or one group may be far better represented than another both by material and species, is obvious. The extinct forms of the families of the present report are subdivided for the matter of convenience between ten more or less homogeneous divisions (including the Hypertragulidæ, thirteen divisions)—such divisions being exemplified in the case of the Antilocapridæ by the Merycodontini and Antilocaprini. The thirteen divisions are further divided into twenty-nine subfamilies—exemplified in the case of the Antilocaprini by the Ilingocerotinæ, Pliocerotinæ, Stockocerotinæ and Antilocaprinæ. The twenty-nine subfamilies embrace seventy-one genera and subgenera. The subfamilies, as originally construed in these studies, were predominantly horizontal groupings. More recent evidence, witnessing the occurrence in the Middle and Late Tertiary, and again in the Late and Uppermost Late Tertiary, of certain closely allied forms which seem to differ only in degree of specialization,

¹ The genera and subgenera total seventy-nine, adding three Bovids (*Poëphagus*, *Simobison* and *Stelabison*), the Cervid *Pediomeryx* and four Camelids (*Pseudoceras*, *Rakomylus*, *Stenomylus* and *Eotylopus*).

² South American Cervini genera are excluded.

has indicated the present use of several of the subfamilies in an additional phyletic sense. Thus the Cervid subfamilies, *Craniocerotinae* and *Dromomerycinae*, as here limited, include Late Tertiary and more progressive Uppermost Late Tertiary forms. Also (though more questionably) the *Barbouromerycinae*, *Aletomerycinae* and *Longirostromerycinae* embrace forms from both the Middle and Late Tertiary. The Antilocaprid subfamily, *Antilocaprinae*, contains genera from both the Late Tertiary and Quaternary. The Protoceratid subfamily, *Synthetoceratinae*, embraces a specialized genus and subgenus from the Late–Uppermost Late Tertiary. (The Camelid subfamily, *Stenomylinae*, includes genera from both the Middle and Late Tertiary.) Notable examples of continuing specialization are afforded by the two remarkable trihorned groups, *Procranioceras-Cranioceras* and *Prosynthetoceras-Synthetoceras*, respectively representing closely allied couplets in the remote Cervid and Protoceratid families. While *Procranioceras* comes from the main, and certain of the *Cranioceras* remains from the uppermost portion of the Late Tertiary, and it is evident that the Cervid *Cranioceras* and Protoceratid *Synthetoceras* are advanced over their respective subgenera, it remains to be determined whether in either family the more progressive genus was restricted entirely to higher beds and the less progressive subgenus confined to lower beds, or whether both subgenera and genera were partly or largely contemporaneous and merely derivatives of parallel developments. However, it may be noted that while *Parablastomeryx*, from the uppermost Tertiary of Nebraska, is more progressive than *Pseudoparablastomeryx* of lower beds, it is less progressive than *Blastomeryx* from intermediate levels.¹

Forms are given generic (or subgeneric) rank on observable differences in the dentition, mandible, skull or cranial appendages, when such characters are believed to indicate the presence of a more or less fundamental difference between the particular form and that next nearest akin. (See footnote 2, page 30.)

Of the ten major divisions, but one (Protoceratini) is represented previous to the Lower Miocene, where three additional divisions first appear. A fifth and sixth division are introduced in the main Late Tertiary and the four remaining divisions first are encountered definitely in the Quaternary—at which time only one (*Antilocapriini*) of the five earlier divisions is still represented. (The three *Hypertragulid* divisions were confined to the Oligocene and Lower Miocene.)

¹ "It is an interesting and significant fact that ancestral and derivative genera may continue to live side by side in the same region." W. B. Scott, 1913, p. 375.

The four families of horned ruminants of the section "Pecora"¹ of North American Middle Tertiary to Recent time, of ten here tentatively recognized divisions, and the (hornless) Hypertragulidæ of three additional divisions, are the respective subjects of the five ensuing chapters:

I.—CERVIDÆ (reconstructions, frontispiece [in part] and Figs. 1, 2D, 19), inclusive of the horned Dromomerycini and Aletomerycini and hornless Blastomerycini of the Middle and Late Tertiary, and the Cervini of the Pleistocene-Recent;

II.—ANTILOCAPRIDÆ (reconstructions, frontispiece [in part] and Figs. 27, 49), embracing the Merycodontini² of the Late Tertiary and the Antilocapriini of the Late Tertiary to Recent;

III.—BOVIDÆ (reconstructions, Fig. 55), of the divisions Antilopini, Ovini and Bovini. The Bovidæ, like the true Cervinæ, possibly were unknown in America previous to the Pleistocene;

IV.—PROTOCERATIDÆ (reconstructions, Fig. 59), here limited to the horned Protoceratini of the Middle to Late Tertiary; and

V.—HYPERTRAGULIDÆ,³ inclusive of the hornless Leptomerycini, Hypertragulini and Hysisodontini of the Middle Tertiary, are of doubtful Pecoran affinity (and see Appendix, VI, Camelidæ, in part).

It may be presumed that the maximum differentiation within the several major families of American horned ruminants in their Tertiary-Quaternary heyday may have been fully equivalent to the remarkable differentiation observable in the case of the Antilopini of modern equatorial Africa. Thus the twenty-one here recognized North American Tertiary-Quaternary genera and subgenera of the Antilocapridæ, and twenty-seven genera and subgenera of the Cervidæ, might be compared with the some twenty genera and subgenera of the one Recent African division, Antilopini.

¹ The Eurasiatic Giraffidæ are absent. [W. D. Matthew (1929, Bull. Geol. Soc. Amer., XL, p. 408) includes in the Giraffidæ the European Tertiary Palæomerycidæ.] The hornless Camelidæ and Oreodontidæ are the subjects of separate reports now in progress.

² Merycodontidæ of Matthew (1904) and Antilocapridæ (in part) of Matthew (1929). Zittel (1893) places *Cosoryx* Leidy, together with *Palæomeryx* and *Blastomeryx*, in the Cervulinæ. Schlosser-Zittel (1923) recognise the one family Antilocapridæ and transfer to this *Hypisodus* Cope (here of the Hypertragulidæ) and *Aletomeryx* Lull (here of the Cervidæ).

³ The Hypertragulidæ has been referred by W. B. Scott (1913) to the Tylopoda and by W. D. Matthew (1929) to the Pecora (see synonymy, Chapter V).

Because of the relative abundance of the fossil data, the present report deals in greater portion with the Tertiary-Quaternary Antilocapridæ and the Tertiary Cervidæ than with the Protoceratidæ, Hypertragulidæ or Bovidæ. Each of the five chapters embraces a tentative reclassification of the known membership of the particular family, including a review of the types and synonymy, and a catalogue and consideration of all of the known fossil evidence. The latter includes that previously described, that amassed during our own field investigations of the past fifteen years and important additional data made available through the generous coöperation of Professor Erwin H. Barbour of Nebraska State University. A total¹ of seven thousand six hundred and forty-three distinct specimens of skulls, jaws, horns, dentitions and limbs is enumerated or described, and of these some five hundred and fifty-two are figured in the drawings of the ninety-three text figures (exclusive of ten pages of reconstructions and photographs).

"Middle" and "Late" Tertiary

Determination of morphological affinity and phylogeny in the families here under discussion, and solution of the attendant problems of local time correlation, must be preceded by a clearer understanding of the nature and number of the forms which comprise each of the particular family groups. Without more data than have yet been available, any lengthy discussion of affinity or origin seems futile. Such discussion must await the accumulation of that mass of first-hand fossil evidence promised by the toil of able collectors. With the primary object of gaining some insight into the actual membership of these extinct American Ruminantia, it has been deemed advisable to consider as respectively broadly contemporaneous the current subdivisions of (a) "Upper Oligocene" to "Lower Miocene" and (b) "Middle Miocene" to "Upper Pliocene." For convenience, the former here are tentatively united as the "Middle" Tertiary and the latter as the "Late" Tertiary. It is not sufficiently recognized that a major break in the mammalian faunas of the Upper Tertiary occurs between the long-current "Lower Miocene" and "Middle Miocene," and that the so-called faunas of the "Middle Miocene," "Upper Miocene" and "Lower Pliocene" yet largely defy such subdivision. Following the "Middle Pliocene," and preceding the "Uppermost Pliocene," there appears to have been a further though less marked cutting-off of old and introduction of new forms. The present study of

¹ The total 7643 specimens is divided as follows: F.A.M. numbers, 5409; A.M. numbers, 1154; N.S.M. numbers, 725; and other numbers, 355. See detailed count under each chapter.

these horned ruminants and uncompleted researches on several contemporaneous family groups indicate the danger of attempting to force the fossil data into undefinable and meaningless periods. Apparent faunistic differences may be due to differences in facies. Thus, in the case of the Middle Tertiary, observed differences may be in large part a resultant of the very probably generally rather humid environment represented by the present known deposits of that time, the fossil yield showing relatively a great prevalence of brachyodont forest-dwelling types. Conversely, in the case of the "drier" Late Tertiary, accumulations with remains of the brachyodont forest-residing types are extremely rare as compared to the many and widely distributed deposits carrying hypsodont plains-dwelling forms. In the Late Tertiary the relative preponderance of evidence as to the tall-crowned Merycodonts, as compared to the meagerness of evidence as to the short-crowned Cervids, is paralleled by a similar relative abundance of data regarding the tall-crowned grazing Protohippines and camelids and scarcity of data as to the short-crowned browsing Hypohippines, tapirs and pigs.

The vanished rivers of the North American Tertiary that frequently may have limited living species, as do today the narrow streams of eastern Africa, occasionally must have mingled in their eddies and deposits the carcasses of creatures coming not only from opposite banks but quite different habitats. Chief among the complications of correlation studies are such mixture of remains from different sources and the uncertainties of local stratigraphy through major inequalities of the ancient depositional surfaces, redeposition through cutting and filling, and the usual disjointed and pockety character of most fossil occurrences.

In the present report, due prominence is accorded evidence as to stratigraphic succession within the here-designated Middle, Late and Uppermost Late Tertiary by the segregation of forms representative of different vertical (and horizontal) distribution under (tentative) stratigraphic (and geographic) species, subspecies or races.¹ There is still probability that a clearer knowledge of the here-considered Pecora eventually may point to certain of the commoner and better-marked genera's or subgenera's usefulness as "time fossils" in the elucidation of stratigraphic problems. In passing, it may be observed that while certain brachyodont Blastomerycini and moderate-crowned Aletomerycini are found in deposits correlated with both the Middle and Late Tertiary, the larger of the brachyodont Dromomerycini and all of the so-far-known hypsodont Merycodontini (relatively plentiful) do not appear

¹ The association of different forms at different localities and in different strata has been recorded as clearly as possible, so that such findings eventually may be readily comparable with the results of similar studies on other groups (the Carnivora, the Equidae and the Camelidae). The final interpretation of the faunal assemblages, of their relative stages and of the sequence of the enveloping strata will never be fairly read except in the light of the whole.

before the Late Tertiary. The hypsodont Antilocapriini¹ seem to arrive only in the latest Tertiary. In the American Middle Tertiary the Cervidæ are represented by Blastomerycini and rare Aletomerycini; the Protoceratidæ are confined to the single genus; and the Antilocapridæ are unknown. With the close of the Middle Tertiary, certain widely differing Aletomerycini suddenly emerge; the larger Dromomerycini for the first time appear; the Middle Tertiary Blastomerycini and Protoceratini are replaced by allied forms; the small hornless Hypertragulidæ vanish; the grazing Merycodontini, heretofore unknown, become widespread and dominant; the once abundant Oreodonts are greatly reduced; and the Camelidæ and Equidæ are continued by a variety of forms of variable affinities. In our collections from the Uppermost Late Tertiary, most of the Dromomerycini, Aletomerycini and Blastomerycini, and the Merycodontini so far are absent though the Antilocapriini are well represented. Certain of the Antilocapriini, camels and horses (their remains usually differentiable from those of earlier horizons) continue into the Quaternary. The true Cervids (in part at least) and Bovids of the American Quaternary are of apparent Asiatic origin. The prevalence in Late Tertiary deposits of tall-crowned Artiodactyls and Protohippines has been interpreted as due to the curtailment of forests and the wide spread of hard grasses. Among the new arrivals of this time are the Proboscideans. The so-far-evidenced vertical distribution of the thirteen divisions of the five families, Cervidæ, Antilocapridæ, Bovidæ, Protoceratidæ and Hypertragulidæ, is indicated in the diagram on the following page. The present recognized distribution of genera, subgenera and species of the four Tertiary families is given in the tables (pages 41-43, 268-269, 597, 618).

In the tables the number assigned to the species in this volume is inserted opposite its genus and below its locality. The species from the type area are marked by () and from other than type areas by []. The localities are provisionally divided between the three subdivisions, Uppermost and Main Late Tertiary and Middle Tertiary. Attachment of formation names to the localities, deposits or quarries is avoided pending the advancement of parallel studies on the Camelidæ, Equidæ and Carnivora. Many problems are yet to be clarified and additional data from the field may indicate the reallocation of certain genera and species. The present allocation must be considered as no more than a convenient working arrangement. The earliest portion of the Sheep-Snake Creek sequence may represent a partial holdover from the Lower Miocene of damp forest-loving forms. It is possible that the Sheep Creek and the Upper Harrison were in part contemporaneous. Forest elements tend to be lacking from the richer collections from the relatively later levels of the Snake Creek sequence where the fauna is predominantly of plains-dwellers. The Lower Snake Creek, Pawnee Creek, Sante Fé and Barstow ostensibly include a number of overlapping phases of the main Late Tertiary. Species from the Burge, Crookston (Valentine)² and Devil's Gulch quarries, Nebraska, suggest separate phases of a

¹ Data point to *Plioceros* and particularly *Texoceros*, *Ilingoceros* and *Osbornoceros* occurring only at higher levels than *Cosoryx*, and the absence of *Cosoryx* in the lower levels where *Meryceros* is generally common.

² Johnson, F. W., 1936, Amer. Journ. Sci. (5), XXXI, p. 467.

generally later sequence. A peculiar southern facies, seen in the Clarendon of Texas, was possibly partially contemporaneous with the last. The poorly represented Ricardo may have pertained to more advanced time. The channel faunas of the Nebraska Upper Snake Creek and Xmas zones, like the faunas of Thousand Creek, Nevada, and the Upper Rio Grande, New Mexico, may have slightly preceded those of Eden, California, Hemphill, Texas, and Guymon, Oklahoma. The three latter, of near Blanco Uppermost Tertiary age, are noteworthy for the occurrence of rare *Hyænarctos*,¹ *Rhynchotherium*² and late camel and horse forms.

DISTRIBUTION OF THE THIRTEEN DIVISIONS OF THE AMERICAN—

		I.— CERVIDÆ	II.— ANTILO- CAPRIDÆ	III.— BOVIDÆ	IV.— PROTO- CERA- TIDÆ	V.— HYPER- TRAGULIDÆ
QUATERNARY	Recent	↑	↑	↑ Antilopini ↑ Ovini ↑ Bovini		
	Pleistocene	— Cervini —	— Antilocapri- —	— — —		
LATE TERTIARY	Uppermost	↑	↑			
	Main	↑ Dromomerycini ↑ Aletomerycini ↑ Blastomerycini	↑ Merycodontini		↑ Protoceratini	
MIDDLE TERTIARY	Lower Miocene	↑ — ↑				↑ Hypetragulini ↑ Leptomery- cini
	Upper Oligocene					↑ Hypisodontini

¹ *Hyænarctos guymonensis*, n.sp., type, crushed cranium, F.A.M.30399, exhibits a dentition closely resembling *H. gregori* of Eden, California, and *H. sivalensis* of the Siwaliks. The Oklahoma skull is the first skull of the genus from America. Detached teeth from Miami Quarry, Hemphill County, that are indistinguishable from *H. gregori*, are referred to a subspecies, *H. guymonensis miamensis*. (*Hyænarctos* is unrecognized as yet from the Blanco.)

² Osborn, H. F., 1936, Proboscidea, I.

RÉSUMÉ OF CERTAIN CRANIAL AND SKELETAL CHARACTERS IN
AMERICAN CERVIDÆ, ANTILOCAPRIDÆ AND BOVIDÆ VERSUS PROTOCERATIDÆ,
HYPERTRAGULIDÆ AND CAMELIDÆ

(See keys to genera and subgenera, pp. 32-39)

p_1^1 lost; C/, when retained, tending caniniform; /C incisiform; p_4 partially molariform; bullæ inflated; metapodials 3 and 4 fused, laterals reduced to lost.

PECORA VERA

Male (except Blastomerycini) with paired supra-post-orbital solid horn-pedicles; dentition brachyodont to subhypsodont..... I.—CERVIDÆ

Male with paired supra-orbital-forked-tending and solid horn-cores; dentition strongly hypsodont..... II.—ANTILOCAPRIDÆ

Male with paired postorbital hollow horn-cores; dentition subhypsodont to hypsodont..... III.—BOVIDÆ

p_1^1 tending retained (absent in Protoceratid *Prosynthetoceras* and *Synthetoceras*); C/ tending detached caniniform; /ps laterally compressed-sectorial; dentition brachyodont to subhypsodont (hypsodont in Hypisodontini); metapodial keels confined to plantar surface.

PECORA DUBIA

Metacarpals short, detached, and laterals generally retained; male with rostral armament and paired postorbital horn-cores; bullæ small..... IV.—PROTOCERATIDÆ

Metacarpals short, detached, and laterals retained; male without horns; bullæ inflated..... V.—HYPERTRAGULIDÆ

TYLOPODA

Metacarpals either short and detached or elongate and consolidated, laterals lost; male without horns; bullæ large, filled; Is/ tending retained, I³ and /C caniniform. . VI.—CAMELIDÆ

Preceding a general discussion of the characters of the Cervidæ, Antilocapridæ and Bovidæ and of the Protoceratidæ and Hypertragulidæ, the five families and thirteen divisions may be very briefly re-enumerated:

I.—Cervidæ

Reconstructions, Frontispiece (in part) and Figures 1, 2D, 19

The extinct deer of the Middle-Late Tertiary of America are considered below under three tentative divisions, Dromomerycini, Aletomerycini and Blastomerycini. The Pleistocene-Recent deer are referred to the Cervini. The three Tertiary divisions include some twenty-one known genera and subgenera, sixteen of which are new to the literature.

The horned and moderate to long horn-pediced Dromomerycini, with short-crowned teeth and largely unreduced premolars, of the Late Tertiary, were represented apparently by smaller forms at earlier levels. All have disappeared before the Pleistocene. They include the remarkable creatures—*Cranioceras* Matthew, *Procranioceras*, n.subg., *Rakomeryx*, n.g., *Dromomeryx* Douglass, *Sinclairiomeryx*, n.g., *Drepanomeryx* Sinclair and *Matthomeryx*, n.subg. Middle Tertiary forerunners of the Dromomerycini are seen in the moderate horn-pediced *Barbouromeryx*, n.g., and the less conservative *Protobarbouromeryx*, n.subg. It seems inadvisable to recognize a family Dromomerycidae. The American Dromomerycini may yet prove to be represented in the Eastern Hemisphere by certain of the broadly contemporaneous "Palæomerycidae." The characters of the *Palæomeryx*¹ cranium still remain in question. Dromomerycini dentitions recall in moderate degree the Recent Cervini, certain of the extinct European forms and the Asiatic-African Giraffidæ.

The tall-pediced and undoubtedly deciduous-horned Aletomerycini of the Middle Tertiary witness the presence in North America at an early date of a highly developed Cervid stock. The division questionably includes several very distinct groups—*Yumaceras* of the Uppermost Late Tertiary, and *Sinclairiomeryx* of the early Late and *Aletomeryx* of the Middle Tertiary—having in common a reduction of the premolars. In their reduced premolars, the Aletomerycinæ proper are more specialized than the Recent Asiatic *Cervulus*, which they parallel in subhypsodont molars and elongate horn-pedicles. Representatives of the Aletomerycinæ² are unrecognized above the earliest levels of the Late Tertiary. Originally *Aletomeryx* proper was referred to the Antilocapridæ. The nasal bosses of *Sinclairiomeryx* recall the armed maxillæ of the Protoceratines.

¹ Premolars of none of the American Dromomerycini are as large-proportioned as in the Museum's example of *P. haupti* or the *Palæomeryx* specimens figured by Filhol.

² It is barely possible that the slender and long-muzzled *Longirostromeryx*, n.g., with greatly reduced premolars, subhypsodont cheek teeth and as yet unknown cranial characters, may prove to be allied to this subfamily.

The only evidence known to the writer that is suggestive of the actual presence in our own Late Tertiary of a true Cervine is a questioned mandibular fragment from the Uppermost Pliocene of Eden, California. Cervini of the several existing genera—the slender-horned *Odocoileus* and *Cervus*, and the palmate *Rangifer*, *Alces* and extinct giant *Cervalces*—were widely distributed in the North American Quaternary. The common ancestral stem of the Quaternary Cervini might be sought among the precursors of the yet scantily known groups here included in the Blastomerycini (exemplified in *Pseudoparablastomeryx*), which recall, in variable measure, such widely remote forms as the Recent *Moschinæ* and *Tragulinae* and the Oligocene *Leptomerycini*. The Tertiary *Dromomerycini*, in horn-pedicles, and the *Aletomerycini*, in dentition, were already more specialized than the modern deer.

Blastomerycini, of varied character, occur in both the Middle and Late Tertiary. Certain forms are suggestive of *Micromeryx* of contemporary European deposits. Through their lack of horns and in the enlarged upper canines of the males, the Blastomerycini tend to parallel the Recent Asiatic *Moschinæ*. The division includes several very different genera and subgenera. While *Parablastomeryx*, in cranial aspect, broadly recalls the figures of *Dremotherium* of the European Tertiary and *Moschus* of Recent Asia, the limb proportions are so widely different that it is evident that no actual connection exists between the extinct American and European or Recent Asiatic forms. *Parablastomeryx* of the Late Tertiary is forecast in the Middle Tertiary *Pseudoblastomeryx*, much as *Longirostromeryx* seems to be in the Middle Tertiary *Machæromeryx*. While the *Blastomeryx* dentition indicates definite Cervid affinity, any theory that the Blastomerycini includes primitive horned forms is yet to be substantiated; none has been observed. William D. Matthew (1908) considered that *Leptomeryx* Leidy of the Upper Oligocene might represent a group lying in the direction of *Blastomeryx*.

The Cervid *Dromomerycini*, *Aletomerycini* and *Blastomerycini* of the Middle and Late Tertiary and Cervini of the Quaternary are treated in detail in Chapter I of this report. See hypothetical reconstruction of heads in the flesh, frontispiece (in part) and Figures 1, 2D, 19, pages ii, xxviii, 44, 188.

II.—Antilocapridæ

Reconstructions, Frontispiece (in part) and Figures 27, 49

The Late Tertiary forerunners of the surviving American pronghorn, as seen in the horn-cores, are considered as of two diverse hypsodont

divisions, the Merycodontini and Antilocapriini. The diminutive and fascinating Merycodontine pronglets are among the best represented of these Tertiary forms. The Antilocapriini are relatively rare and their known remains are largely confined to relatively late horizons. They might be divided for convenience into forked-tending and elongate-twisted-tending horn-core groups. Middle Miocene representatives of the Antilocapridæ are as yet unknown. Four of the six subfamilies belong to the Late Tertiary (Ramocerotinæ and Cosorycinæ of the main and Ilingocerotinæ and Pliocerotinæ of the Uppermost Late Tertiary), and two to the Tertiary and Pleistocene-Recent (Stockocerotinæ and Antilocaprinæ).

Two or more distinct kinds of horns or horn-cores seem to have been evolved by the respective branches of the Antilocaprid family:

- (1) Antler-like with tendency to burr, which, in certain forms, probably was deciduous as in the deer, exemplified in the Ramocerotinæ—"Pseudocervicorn"¹—and
- (2) Forked, burrless, with deciduous sheath, exemplified in the Antilocaprinæ—"Pliocervicorn."

The probability of the *Ramoceros* horn being in degree deciduous, and the new evidence as to horn growth in *Ramoceros* and in *Cosoryx*, are discussed below (see Merycodontini "Horns," page 280).

An hypothetical series exemplifying possible former stages in transition from the forked horn-core to the simple core of the modern pronghorn, noting that a single modern blade-like (though stubby) horn-core was borne as early as the Late Tertiary by *Proantilocapra*, is suggested by the cores of four contemporaneous Quaternary forms, the:

- (a) symmetrically forked core of *Stockoceros* (compare the rather similar core of the Tertiary *Plioceros* and somewhat similar but burred horn of Tertiary *Meryceros*);
- (b) disproportionately elongated posterior fork of *Hayoceros*; or
- (c) much reduced anterior fork of *Capromeryx*, and the
- (c') abrogated anterior fork of the core (with retention of the fork by the sheath alone) in *Antilocapra*.

The spiraled horn-cores of *Ilingoceros* and *Osbornoceros* recall parallel adaptations in the Tragelaphinæ of Africa and the Suleman Markhor of Asia.

Hypsodont and smooth-textured Merycodontine and Antilocaprine molars, the former confined to the American Late Tertiary and the latter continuing into the Quaternary and surviving in the Recent pronghorn, are as yet unknown from Eurasiatic horizons. While the present evidence is that these tall-crowned groups were wholly of American origin and distribution, there is the possibility that closely related forms yet will be discovered in the little-known Tertiary of Asia. It is amazing

¹ See discussion, page 26.

that all of these varied Antilocapridæ should have become extinct before the close of the Quaternary, except for the one genus and species, *Antilocapra americana*.

The Merycodontini and Antilocaprini are considered in detail in Chapter II. The heads of outstanding examples are shown hypothetically in the flesh in the frontispiece (in part) and Figures 27 and 49.

III.—Bovidæ

Reconstructions, Figure 55

The Bovids, or hollow-horned ruminants of the American Quaternary, superficially may be considered as of three grand divisions, the Antilopini, the Ovini and the Bovini. The American Antilopini, as here interpreted, embrace the goat-antelope, *Oreamnos*; the questioned *Neotragocerus*; and the gazelle-antelope, *Saiga*, here first described from this continent. The loosely drawn Ovini include the Euceratherinæ, the Ovinæ and the Ovibovinæ. The Bovini are represented by *Bison* and (?)*Poëphagus*, the latter here first recorded from the Western Hemisphere. As discussed in Chapter III, the Bovidæ was probably largely of Eurasiatic origin. The discovery of the saiga and of the yak-like form in the Quaternary of Alaska is unexpected.

IV.—Protoceratidæ

Reconstructions, Figure 59

The strange multiple-horned, short-footed Protoceratids—or “protoceratines”—of the Middle and Late Tertiary are referred to a single division, Protoceratini. The armed muzzle is recalled in the case of the deer by the nasal bosses of the recently discovered *Sinclairiomeryx* cranium.

The Protoceratidæ was erected by Marsh in 1891 for reception of the then newly described White River *Protoceras*. [Matthew (1909) and Scott (1913) referred the latter genus directly to the Hypertragulidæ.] *Syndyoceras* Barbour (1905) represents an allied genus from the Lower Miocene. *Paratoceras*, n.g., *Synthetoceras* Stirton (1932) and the equally curious *Prosynthetoceras*, n.subg., witness the survival into the Late Tertiary of highly specialized members of this group. The family of the one division, Protoceratini, is discussed in Chapter IV. The heads are reconstructed, Figure 59.

V.—Hypertragulidæ

The status of the Hypertragulidæ is much confused in the literature. The genus *Leptomeryx* has been cited as ancestral to both the deer and *Antilocapra*. Discussion of the affinity of several of the here included genera will be carried further in the forthcoming report on the Camelidæ, at which time additional evidence may be available. The hornless Leptomerycini, Hypertragulini and Hypisodontini, embrace a number of extremely diverse and variably brachyodont to hypsodont forms. The non-Pecoran character of the same is witnessed in the detached caniniform p_1^1 , the compressed and frequently aborted condition of the anterior premolars, the short proportions and usually unconsolidated condition of the metapodials and the incomplete metapodial keels.

A Late Tertiary form, *Pseudoceras*, n.g., suggestive both of *Hemoschus* and the camel, and a Late Tertiary representative of the aberrant Middle Tertiary camel, *Stenomylus*, are discussed in the Appendix, Chapter VI.

Characters in the American Pecora

In the detailed consideration of the many forms here enumerated or studied, clarity is gained and unnecessary and confusing repetition avoided by stating at once those characters which are assumed to be germane to all and those other characters which separate the five families, Cervidæ, Antilocapridæ, Bovidæ, Protoceratidæ and Hypertragulidæ.¹ In the horned forms of the American Late Tertiary so far observed, the cranial axes are considerably bent. A broad contact² usually exists between the premaxillæ and the nasals. The orbits (typically) are closed. Lacrimal vacuities (excepting Bovidæ and Protoceratidæ), infra-orbital and supra-orbital foramina are present. The upper incisors are lost and p_1^1 are absent (except in *Protoceras*, *Syndyoceras* and the Hypertragulidæ, where the p_1^1 are present and detached as in the Camelidæ). Dp_1 (p_1) may be lost (*Cranioceras* and *Cosoryx*) or retained non-detached (*Dromomeryx*). The C/ may be absent in the Cervids (*Dromomeryx*), or enlarged caniniform (males of Blastomerycini, Cervulinæ and Moschinæ). The C/ occasionally is present in the Antilocaprids (male of *Meryceros*). The /C is always incisiform. (The p_2^2 are de-

¹ Subsequent to the allocation of a dentition or partial dentition to a particular family and genus where the typical dentition is already known (and has been carefully figured) there is little excuse for needless duplication by re-mention of such dental characters and minutæ (in the description of species). (See footnote 2, page 30.)

² *Saiga* is a noteworthy exception.

tached from the p_3^3 only in the Hypertragulini.) Notable differences exist in the length of the symphyses and diastemata,¹ in the proportions of the premolars and molars, in the height of the tooth crowns and in the form of the cranial appendages.

Facial fossæ are typical of the deer; lacrimal vacuities are present in both Cervids and Antilocaprids, and absent in the Bovids and Protoceratids. The form of the cranial occiput tends to be characteristic of the several families though the same may vary greatly in a single family as exemplified in the case of the Cervidæ. The form of the bullar region is worthy of particular investigation (see Fig. 2A). In the Cervidæ the bullæ are moderate, in the Antilocapridæ much inflated, in the Bovidæ swollen, in the Protoceratidæ uninflated, in the Hypertragulidæ inflated, in the Camelidæ large and filled, and in the Oreodontidæ peculiarly characteristic. The position of the hyoid depression tends to be typical in several of the families, the same being notably posterior in the case of the Cervidæ.

CRANIA AND HORNS (FIG. 2)

The position and form of the horn-pedicle or -core and proportions of the crania in the case of certain examples of the Cervidæ, Giraffidæ, Antilocapridæ, Protoceratidæ and Bovidæ are indicated in the scaled outlines of Fig. 2.

In the Tertiary deer the skull is apt to be somewhat slender, the cranium posterior to the orbits proportionately elongate and the horn-pedicles tall and superimposed over the orbits, as compared to the condition in Recent American Cervids—where the orbits tend to be more prominent, the posterior cranium to be fuller and less produced, and the horn-pedicles (the extreme being seen in *Rangifer*) to be relatively posterior. An instructive parallel to the elongate horn-pedicles of the Tertiary forms is observed in the Recent Asiatic muntjac, *Cervulus*. In the Cervidæ the horn-pedicles may be directed either anteriorly or posteriorly. The “horns” of the giraffe (ossified from separate centers and pointing posteriorly) and of *Synthetoceras* (pointing postero-outwardly) are distinct from the horn-pedicles of the deer and -cores of the pronghorns. In the Antilocapridæ the definitely supra-orbital cores may tilt slightly forward as in the pronghorn, or posteriorly as in *Plioceros*. In the Bovidæ the hollow horn-cores incline posteriorly of the vertical, as in *Oreamnos* and *Ovis*, or are strongly depressed, as in *Bison* and *Ovibos*. The scaled sketches indicate the variable condition of the premaxillary border, as well as the relative position of theinion, condyles, foramina, the extent of the cheek tooth series, and the absence or presence of facial vacuities and depressions.

¹ The comparison of diastema lengths in broken ramal specimens is complicated through the actual lengths in any one specimen being dependent on the size of the individual, wherefore the diastema in a larger individual with moderately proportioned symphysis may measure longer than in a smaller individual with a longer-proportioned symphysis.

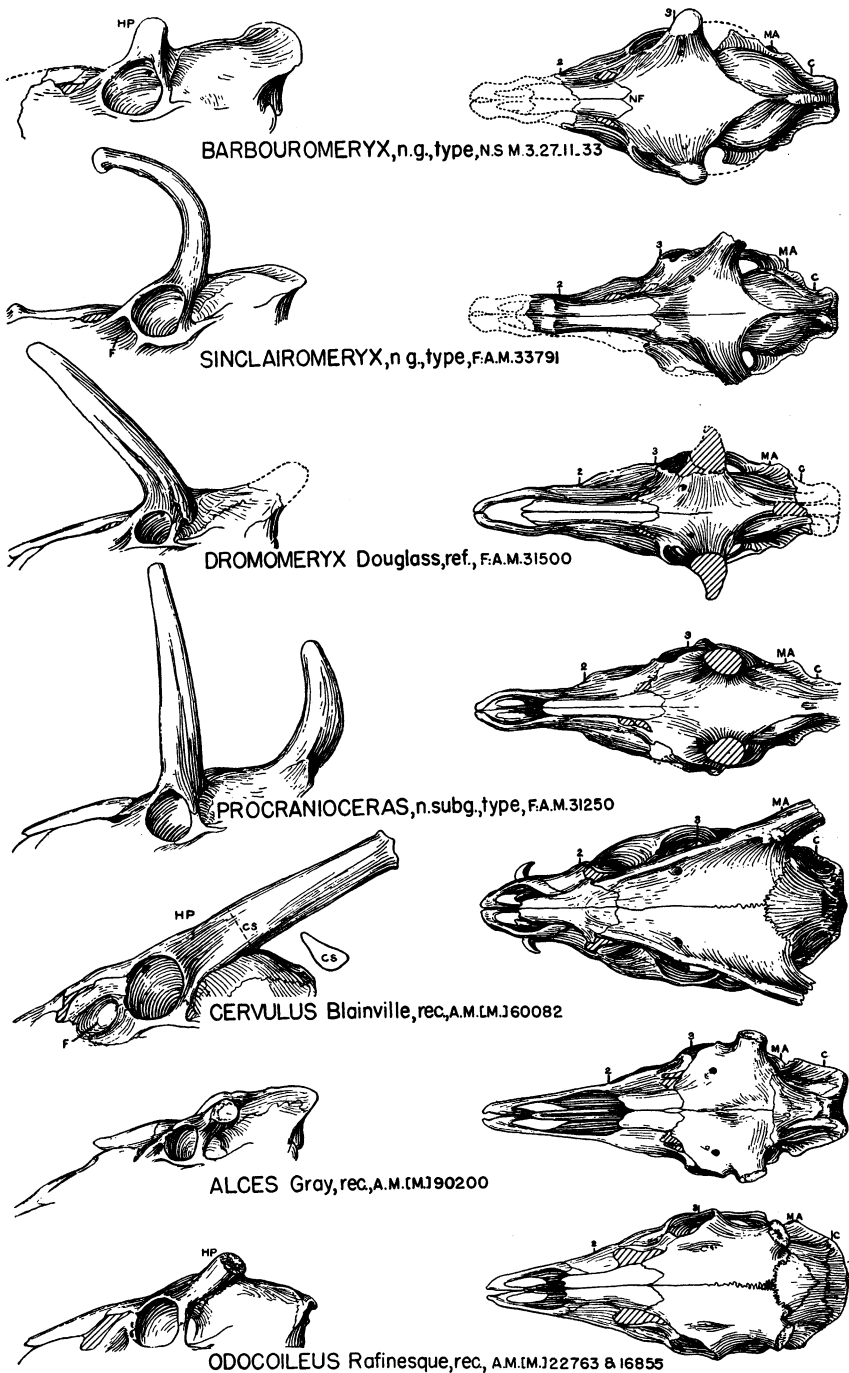


FIG. 2. Contrasted cranial proportions and horn-pedicle or -core form and position in examples of Cervidae, Giraffidae, Antilocapridae, Protoceratidae and (Continued on next page)

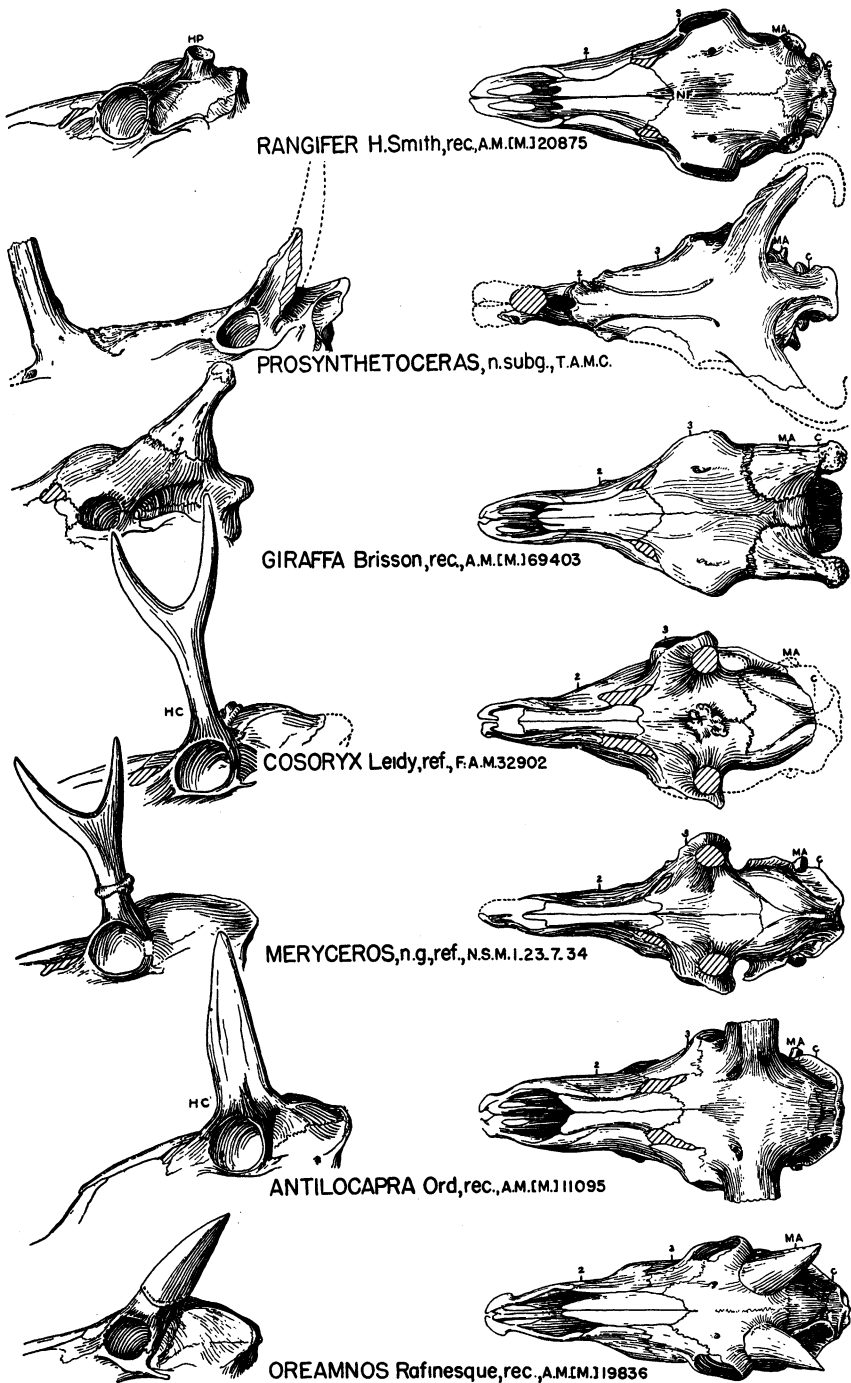


Fig. 2 (continued from preceding page)

Bovidae. (Premaxilla-vertex distances reduced to unity.)

C = condyle; CS = cross section of orbital "horn"; F = maxillary pit of deer; HC = horn-core; HP = horn-pedicle; MA = auditory meatus; NF = nasofrontal suture; 2 = anterior edge of p^2 ; 3 = posterior edge of m^2 .

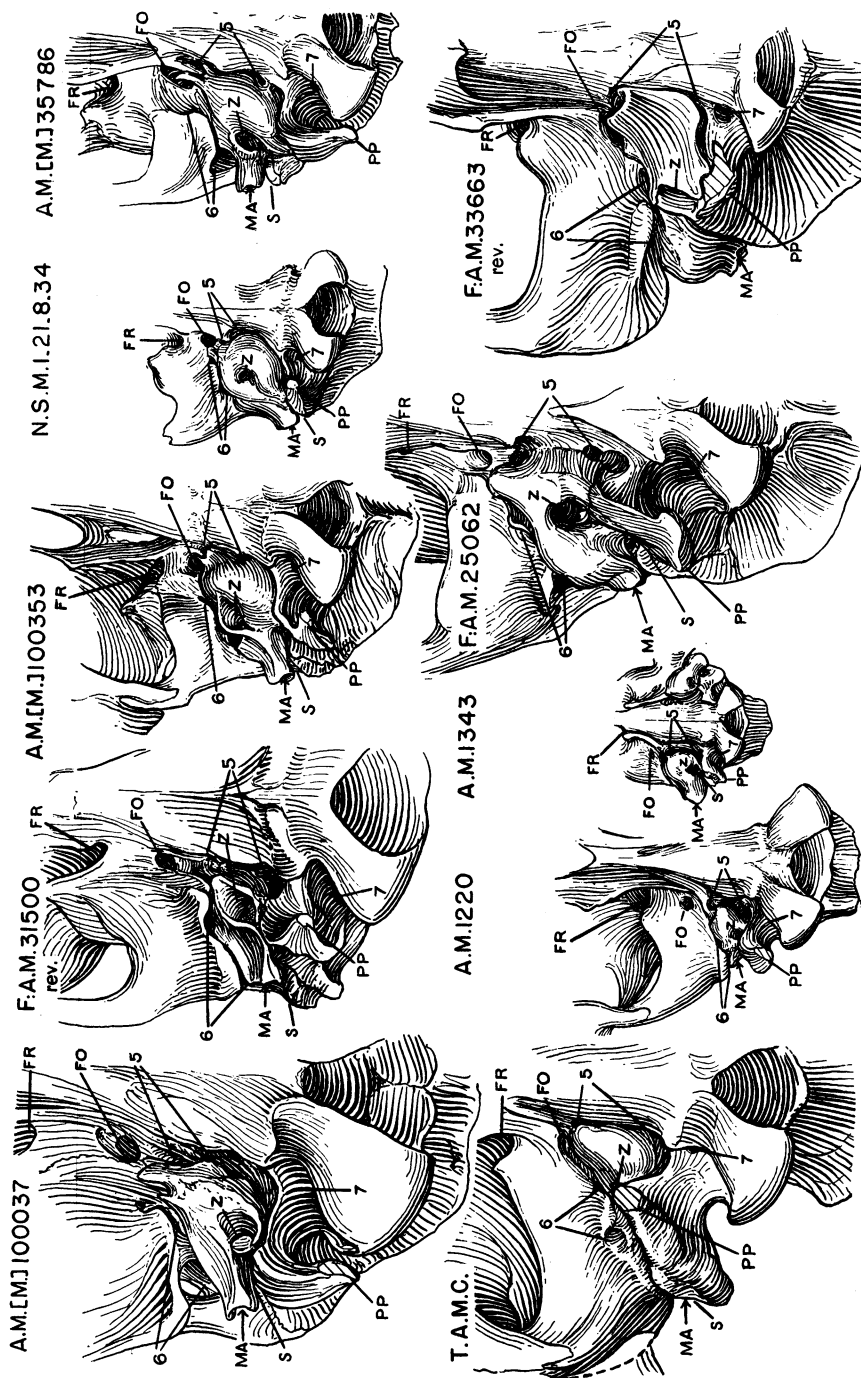


Fig. 2A. Comparison of the bullar region of the skull in Middle and Late Tertiary and Recent Artiodactyls.
X 4. (See legend, page 23.)

TEETH

The tooth plan in the Cervidæ and Antilocapridæ is confined largely to minor variations of the two (conservative) patterns respectively exemplified by the Recent:

Deer—dentition brachyodont to subhypsodont, and
Pronghorn—dentition highly hypsodont.

While there are forms with somewhat shorter- or longer-crowned teeth in each family, there is as yet (even irrespective of cranial and other characters) no known phylogenetic series exhibiting (actual) passage from a "deer" to a "pronghorn" dentition. It may be presumed that the "acquisition" of taller-crowned teeth occurred independently in each family as in the Equidæ.

The low- to moderate-crowned tooth forms embrace the Cervid:

(a) brachyodont Dromomerycini, which exhibit bizarre specializations of the horn-pedicles and include the three-horned Cranioceratinæ, the Dromomerycinæ, the Barbouromerycinæ and Drepanomerycinæ;

(b) subhypsodont Aletomerycini and Cervini, provided with variable-lengthed horn-pedicles bearing deciduous caps or antlers; and

(c) brachyodont Blastomerycini, which were hornless, so far as known, and had enlarged Cs/ in the males (as in the Recent Asiatic Moschines).

The short brachyodont to subhypsodont molars also occur in the (Giraffids and) Protoceratids and Hypertragulids.

The tall-crowned tooth forms are confined to the Antilocaprid:

(d) Merycodontini of diverse horn or horn-core design. Pending the solution of the horn morphology, the Merycodontini tentatively may be considered as of two sections: (d') Ramocerotinæ, in which the Cervid-antler-like horns were probably deciduous, and (d'') Cosorycinæ, with forked horn-cores of special form. And

(e) Antilocapriini of several distinct subgroups with forked-tending horn-cores that include: (e') the diversified forms of the Quaternary, near relatives of the sole survivor (pronghorn) of Recent time, and (e'') a series of allied specializations and the remarkable twisted-cored Ilingocerotinæ of the Late Tertiary.

Extremely hypsodont to moderately hypsodont molars are exemplified, respectively, by the pronghorns and Bovids of the Quaternary.

The dental pattern within the brachyodont and hypsodont groups is remarkably homogeneous. Tooth variation in the case of each group is confined largely to size, interproportions of the premolars, molars and last molars, subsidiary differences in the presence or absence of cingula and accessory folds, and the degree of molariformity in the p_4 . While the

(A) brachyodont forms are characterized by the rugosity of the unworn cheek teeth, a tendency in the upper molars to basal cingula, intercolumnar tubercles and variably developed external styles, and in the lower molars to the presence of anterior "Auchenia" and posterior cingula, "Palæomeryx" folds and intercolumnar tubercles, the

(B) hypsodont forms are furnished with smooth-surfaced molars having tall prismatic crowns that generally lack early-formed roots, as well as cingula, or accessory folds and tubercles, though the latter occasionally may be present.



FIG. 2B. Comparative form and pattern of the p_4 and of the proportions of p_4 relative to m_3 in examples of the brachyodont to subhypsodont Cervidae, Protoceratidae and Hypertragulidae, and in the hypsodont Antilocapridae and Bovidae.
(Continued on next page)

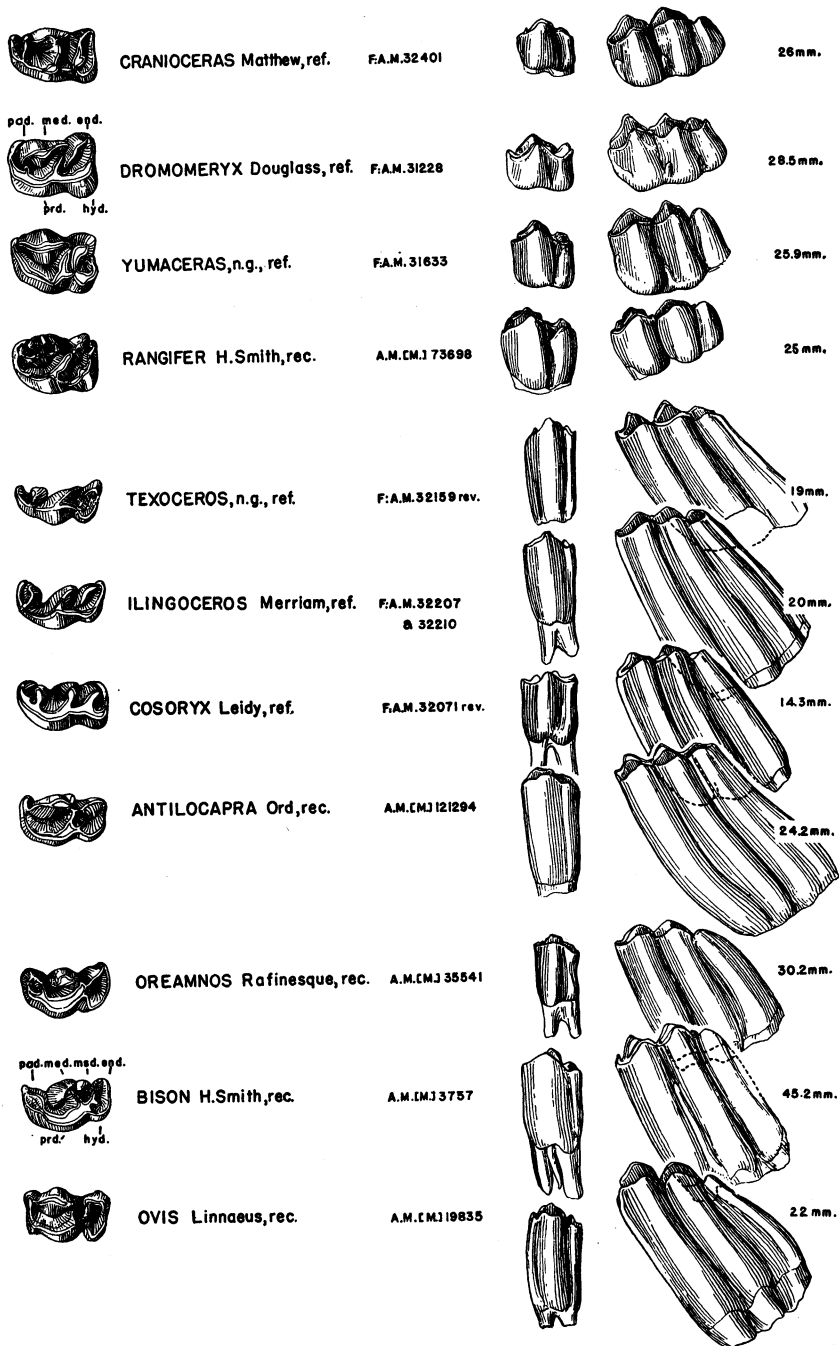


FIG. 2B (continued from preceding page)
(Anteroposterior diameters of p_s , occlusal views, and of m_s , lateral views, respectively brought to unity.)

end., entoconid; hyd., hypoconid; med., metaconid; msd., metastylid; pad., paraconid; Trd., protoconid. Measurements in the right-hand column are the actual anteroposterior diameters of m_s . (Continued, Figure 67, page 654.)

This figure has not been cited in the detailed lists.

The p_4 , through its tendency to approach molariformity in different members of the Pecora, retains a diagnostic character to greater degree than any other tooth of the series. The pattern of the p_4 and the p_4 proportions relative to m_3 are shown (Fig. 2B) in unworn to slightly worn examples of the Camelidæ, Hypertragulidæ, Protoceratidæ, Cervidæ, Antilocapridæ and Bovidæ.

The Camelid p_4 is relatively simple, there being no metaconid and the crests being confined to the protolophid (paraconid-protoconid) and compressed talonid (metastylid-entoconid and hypoconid)—which occasionally encloses, or partially encloses, a lenticular fossa. (In Recent *Hyemoschus* the p_4 is of similar compressed sectorial form to the camel but may be larger compared to its m_3 .)

The unworn to slightly worn p_4 of:

Hypertragulus is primitive in the detached and rudimentary condition of the metaconid and entoconid columns, which are separated from the main external crest by a longitudinal crease.

Pseudoceras, in place of the typical antero-median metaconid, exhibits a postero-median "metastylid."

Synthetoceras and of *Paratoceras* similarly substitutes "metastylid" for metaconid and, in the worn p_4 , this unites with a diminutive entoconid and the hypoconid margin to enclose a posterior pit. The *Synthetoceras* p_4 is proportionately small and the m_3 tall-crowned compared to *Paratoceras*. (A somewhat parallel development of metastylid versus metaconid is seen in the hypsodont *Texoceros* and *Ilingoceros*.)

Parablastomeryx and of *Blastomeryx* is of simple Cervid pattern, the small metaconid and entoconid separately uniting with the proto-hypolophid crest.

Cranioceras, of *Dromomeryx* and of *Yumaceras* is characterized by the metaconid being large and extended and united anteriorly and posteriorly with crotchets from the protoconid so as to shut in an anterior fossette. In *Procranioceras* the metaconid is unexpanded and the fossette unformed.

Sinclairiomeryx and of *Longirostromeryx* retains a definitely Cervid pattern though the p_4 is small relative to the m_3 .

Rangifer exhibits the metaconid as a separate and complex column, un-united with the protolophid, and an entoconid and hypoconid of similar detached columnar form.

Antilocaprids and of Bovids (versus Cervids) is tall-crowned though at times, as in *Meryceros* and *Oreamnos* (and *Saiga*), small relative to the much enlarged and tall-crowned m_3 .

Merycodonts differs from that of *Texoceros* and *Ilingoceros* in the tendency to development of the metaconid rather than metastylid portion of the median acces-

¹ The cusps of the p_4 , following an interpretation of the Osborn terminology, may be known as:

Antero-outer cusp, protoconid; postero-outer, hypoconid; antero-inner, paraconid; median-inner, (anterior corner) metaconid (and posterior) metastylid; and postero-inner, entoconid. The same cusps may be developed in the p_2 and occasionally traces of these may occur in the p_2 (see *Rangifer*). The paraconid and protoconid form the protolophid. Crotchets from the protolophid may unite this with the hypoconid and the entoconid and at times with the metaconid (into a typical "E" pattern). The metaconid may be conveniently considered as tending to be replaced by a variably developed metastylid in the brachyodont-subhypsodont camel, *Hyemoschus* Gray (1845), *Pseudoceras*, *Synthetoceras* and *Paratoceras*, as well as in the hypsodont *Plioceros* and *Ilingoceros*. The main cusps, crotchets and lophes are well shown in the Cervid *Dromomeryx* and *Yumaceras* of Fig. 2B.

Compare: RÜTIMEYER, 1883, Abhand. der Schweiz. Paläont. Gesellsch., X; LOOMIS, 1925, Bull. Geol. Soc. Amer., XXXVI, p. 591; idem, 1928, Amer. Journ. Sci. (5), XVI, p. 531.

sory column. In the p_4 of the Recent pronghorn, both metaconid and metastylid are developed, enclosing anterior and posterior fossettes.

Bovids may have a formed anterior fossette as in *Ovis*, or be open as in *Oreamnos* and (typically) in *Bison*.

LIMBS

The limb elements in the ruminant groups under discussion differ in variable degree in size and proportions and, in measure, are characteristic of the several families. Unfortunately such elements are found but rarely in association with skull and jaws, and in certain genera still are unrecognized. For convenience of reference the fossil data relative to the limbs are segregated and separately detailed at the end of the respective chapters. Tables of the limb measurements and proportions of Recent and fossil species are included, so far as possible, in the discussion of the several families, and certain metapodials are figured. An interesting comparison, where the material allows, is that of the metapodial and skull lengths (see page 24), the metapodials tending to be slenderer and more elongate in the Antilocapridæ than in the Cervidæ, more moderate-proportioned in the Bovidæ, and shorter and unconsolidated in the Protoceratidæ and Hypertragulidæ. Broadly speaking, in these several families the ulna remains distinct, the fibula is greatly reduced, the carpus is of standard pattern and the navicular and cuboid are united. In the Cervidæ (versus certain of the Antilocapridæ), Bovidæ and Protoceratidæ, the radius is long relative to the metacarpus, the metacarpus and its second phalanx are shorter than the metatarsus and its phalanx and the laterals frequently are retained. (Middle Tertiary

FIG. 2A. Comparison of the bullar region of the skull in Middle and Late Tertiary and Recent Artiodactyls.

× $\frac{1}{2}$. FO, foramen ovale; FR, foramen rotundum; MA, auditory meatus; PP, paroccipital process; S, stylomastoid foramen; Z, depression for tympanohyal; 5, lacerated foramina; 6, glenoid foramina; 7, condylar foramen.

I.—CERVIDÆ. A.M.[M.]100037, *Cervus canadensis* Erxleben (Recent).

F:A.M.31500, *Dromomeryx whitfordi* Sinclair, ref., rev., Sioux Co., Nebr. (See also Figs. 2, 14 and page 118.)

II.—ANTILOCAPRIDÆ. A.M.[M.]100353, *Antilocapra americana* Ord (Recent).

N.S.M.1-21-8-34, *Meryceros warreni johnsoni*, n.subsp., ref., Cherry Co., Nebr. (See also Fig. 28C and page 363.)

III.—BOVIDÆ. A.M.[M.]35786, *Oreamnos montanus* (Ord) (Recent).

IV.—PROTOCERATIDÆ. T.A.M.C., *Prosynthetoceras francisi*, subgenotype, San Jacinto Co., Tex. (See also Figs. 2, 60-63 and page 606.)

A.M.1220, *Protoceras celer* Marsh, ref., Cheyenne River, S. Dak. (See page 611.)

V.—HYPERTRAGULIDÆ. A.M.1343, *Leptomeryx evansi* Leidy, ref., Lower Oreadon Beds, Cheyenne River, S. Dak. (See page 628.)

VI.—CAMELIDÆ. F:A.M.25062, specimen, Cherry Co., Nebr.

VII.—OREODONTIDÆ. F:A.M.33663, *Metoreodon* species, rev., N. Mex.

deer may retain the lateral metacarpals complete.¹⁾ In *Antilocapra* proper the limbs and feet are slender, the humerus and pes are shorter, the first phalanx of the manus is longer proportioned, the metacarpal length approximates the metatarsal, the metacarpus is less deeply grooved posteriorly and the metatarsus anteriorly; all laterals are absent and the third phalanx of the manus is deeper, blunter anteriorly and more extended posteriorly than in the deer. (Late Tertiary Merycodonts may retain the lateral splints and rudimentary phalanges in the manus.²⁾)

METACARPAL LENGTH RELATIVE TO SKULL LENGTH
(Skull length measured from back of condyles to front of premaxillæ)

[GIRAFFIDÆ]				
<i>Giraffa camelopardalis reticulata</i>	A.M.(M.)82001	Brit. E. Africa	730/645	= 113%*]
CERVIDÆ				
<i>Parablastomeryx gregorii</i>	F:A.M.31360	Nebraska	151/(160)	= (94)%
<i>Barbouromeryx trigonocorneus</i> ...	N.S.M.3-27-11-33	"	143/(185)	= (78)%
<i>Pseudoblastomeryx falkenbachii</i> ..	F:A.M.31530	Wyoming	90/(120)	= (75)%
<i>Aletomeryx marslandensis</i> (♀)...	Unassociated	Nebraska	151/195	= ((77))%
<i>A. gracilis</i>	Average unas- sociated	"	121/(173)	= ((70))%
<i>Dromomeryx borealis</i>	C.M.827	Montana	220/(330)	= (67)%
<i>D. whiffordii</i>	Unassociated	Nebraska	/380	= ((67))%
<i>Procranioceras skinneri</i>	F:A.M.31251	"	172/270	= 60%
<i>Machæromeryx tragulus</i>	A.M.20548	"	73.5/(111)	= (66)%
Recent Cervinæ (p. 190).....				77-59%
ANTILOCAPRIDÆ				
<i>Plioceros dehlinsi</i>	F:A.M.32101	Nebraska	125/(152)	= (82)%
<i>C. (Paracosoryx) wilsoni</i>	Unassociated	"	107/(143)	= ((75))%
<i>Cosoryx furcatus</i>	F:A.M.32450	"	98/(135)	= (73)%
<i>Meryceros warreni johnsoni</i>	Average unas- sociated	"	122/179	= ((68))%
<i>M. nenzelensis</i>	Unassociated	"	130/(202)	= ((64))%
Recent <i>Antilocapra</i> (p. 541)				83-74%
BOVIDÆ (Recent) (p. 541)				66-35%
PROTOCERATIDÆ				
<i>Protoceras celer</i>	Unassociated	South Dakota	89/213	= ((42))%
<i>Synthetoceras tricornatus</i>	Unassociated	Texas	150/410	= ((37))%
HYPERTRAGULIDÆ				
<i>Leptomeryx evansi</i> , var.....	C.M.997	Nebraska	49/(84)	= (58)%
"	Unassociated	"	40/(109)	

* Length metacarpus/length skull.

() approximate; (()) estimated.

¹ As observed by Professor Barbour in the case of (?) *Aletomeryx marslandensis*, ref.—presence or absence of the laterals in the case of the pes indeterminate (page 186). Communicated November, 1936.

² See recently secured largely complete skeleton of an immature individual of *Paracosoryx wilsoni*, from Sioux County (page 316).

Differentiation and Parallelism in the Cervidæ and Antilocapridæ

The Cervidæ and Antilocapridæ, to which the present volume is largely confined, have certain broadly common characters and exhibit in some respects a corresponding range of diversification. Thus, the:

- Size may be small to large with limbs short to longer-proportioned;
- Jaws and diastemata abbreviate to elongate;
- Tooth crowns more or less strongly brachyodont (deer), or hypsodont (pronghorn);
- Premolars, relative to molars, larger or smaller; and the
- Cranial appendages may take the form of either shorter or taller horn-pedicles (deer), or forked to antler-like horn-cores (pronghorn)—see below.

Examples of this parallelism may be cited in each of the two families:

- Small size—the Cervid *Blastomeryx* and Antilocaprid *Submeryceros*; and
- Large size—the Cervid *Yumaceras* and *Dromomeryx* and Antilocaprid *Texoceros*
- Shortness of the diastema and large size of the premolars—the Cervid *Pseudoparablastomeryx* and the Antilocaprid *Paracosoryx*; and
- Maximum elongation of the diastema and reduction of the premolars—the Cervid *Longirostromeryx* and the Antilocaprid *Subcosoryx*.
- "Horn" simplicity—the Cervid brocket and the Antilocaprid *Meryceros*; and
- "Horn" complexity—the stag and the Antilocaprid *Ramoceros*.

The extreme production of the occiput resulting in the third or occipital horn of *Cranioceras* appears to be no more than a magnification of the incipient production occurring in *Dromomeryx*. No parallel to this exists in the Antilocapridæ. Rostral appendages which culminate in the great forked horns of *Synthetoceras* and *Prosynthetoceras* may occur in modified form in the Cervidæ (*Sinclairiomeryx*, n.g.) but are unknown in the Antilocapridæ.

"Horns," Horn-Pedicles and Horn-Cores

See Figure 2 and Cross Section

Some five kinds of cranial armament are evolved in the males of the several groups through elevation of the frontal bones and variable adaptation of the adjacent skin-hair covering. The growth of such "horns" may be traced in any one genus and species through a series of individuals from the smooth frontal state of immaturity to the horned stages of maturity. It is possible to select certain actually largely con-

temporaneous genera as broadly exempling as many hypothetical stages in the "evolution" of the most complex of such appendages, thus:

(1) "SINECORN," a primitive hornless stage (paralleling the condition in the immature of all, and in the females of many, of the horned forms)—Cervid Blastomerycini (Family I, Division D) and Hypertragulid Leptomerycini, Hypertragulini and Hypisodontini (Family V, Divisions A, B and C).

(2) "PSEUDOCORN," an "elementary" stage of smaller to larger supracranial excrescences, skin- and hair-covered and enlarged through life (paralleled at times in adolescent and in female individuals of other groups)—The Giraffidæ of Asia and Africa and Protoceratidæ (Family IV).

(3) "CAVICORN," a balanced and continuing adjustment between the growing, hollow horn-core and its persistent sheath (both sexes)—Bovid Antilopini, Ovis and Bovini (Family III, Divisions A, B and C).

(4) "PLIOCERVICORN," an adaptation presumably permitting periodic shedding and replacement of the sheath, and "ANTILOCAPRICORN," a more progressive adaptation of the same order. Forked to blade-like and solid horn-cores with deciduous to partially deciduous envelope—Antilocaprid Antilocapriini (Family II, Division B).

(4a) "PSEUDOCERVICORN," interpreted as an elaboration of the "Pliocervicorn" stage involving a splitting of the solid "core" into "incipient pedicle" and distal "core-envelope" portions, and a shedding or partial shedding of the latter. Solid forked core (*Cosoryx* and *Meryceros*) or branched core-antler on more or less differentiated frontal pedicle (*Ramoceros*)—Antilocaprid Merycodontini (Family II, Division A).

(5) "CERVICORN," a permanent and solid frontal pedicle, skin-covered and bearing a deciduous capping or antler and inclusive of "Cervicorn primitiva," tall-proportioned pedicle, and "Cervicorn" proper, short pedicle bearing relatively tall antler—Cervid Dromomerycini, Aletomerycini and Cervini (Family I, Divisions A, B and C).

While the brachyodont to hypsodont Cervids and the hypsodont Antilocaprids and Bovids severally exhibit some four or more major types of paired frontal appendages:

Solid pedicles.....	"Cervicorn,"
	"Pseudocervicorn" and
Solid cores.....	"Pliocervicorn" and
	"Antilocapricorn," or
Hollow pedicles.....	"Cavicorn."

The Cervids and Protoceratids, unlike the Antilocaprids and Bovids, in addition contain groups which develop:

Accessory rostral appendages.....	<i>Sinclairiomeryx</i> and Protoceratini;
Accessory occipital appendages.....	Cranioceratinae and Protoceratini; or are
Entirely hornless.....	Blastomerycini.

Among forms of the eastern hemisphere—the male of the existing giraffe may bear a third or (naso-) frontal "horn"; a second and anteriorly placed pair of horns occurs on the frontals of the antelope, *Tetraceros*, in certain sheep and very occasionally in other members of the Bovidæ.

HORN DEVELOPMENT AND FORM

Among Middle Tertiary deer the sequence of growth stages in the development of the horn-pedicle within the individual from youth to advanced maturity is exemplified particularly well by our fine *Aletomeryx* series (Fig. 16). *Dicrocerus*, of the European Late Tertiary, further witnesses the antiquity of the Cervid antler whose most primitive spiked-horn stage is retained in the South American brocket and in the *Cervus* and *Odocoileus* yearling buck. With the occurrence in the American Middle Tertiary (and European Late Tertiary) of fully developed Cervuline-horned forms, it is unnecessary to search for ancestral stages of horn development within the Middle Tertiary Blastomerycini. By the Middle Tertiary the primitive frontal-excrecence stage in process of evolution into a definitely horned stage, had long since passed. It must be presumed that the Dromomerycine and Aletomerycine "horn-core" was actually a horn-pedicle which in life was covered with skin and hair, and periodically bore distally a corneous capping of "antler" form. In immaturity, and doubtlessly in maturity in certain of the less specialized forms, the capping would have approached in simplicity to that in immature *Cervus* (and *Antilocapra*). Both Recent and extinct Cervid genera are characterized by the form and position of the horn-pedicles (Fig. 2).

There is evidently a slightly different morphology in the case of the horn-pedicles of the four Cervids:

- (a) *Dromomeryx*—probably primitively capped,
- (b) *Aletomeryx*—possibly with *Cervulus*-like antlers,
- (c) *Sinclairiomeryx*—in respect to its nasal bosses, and
- (d) *Cranioceras*—in respect to the third or cranial horn.

The widely varying character of the cranial appendages among the Antilocapridæ has been noted on a preceding page. Highly specialized antlered types of horns seem to have been evolved, surprisingly enough in the Antilocaprid *Ramoceros*, n.g., as well as in the Cervidæ. Recent evidence for the first time exhibits the adolescent "horn" stage in both *Meryceros*, n.g., and *Cosoryx*. The evenly worn condition of the core-tips of a *Meryceros* cranium from Crookston seems indicative of a periodically non-sheath covered "core" renewed through shedding, versus the sheath-protected and permanent core of the Antilocapriini. (Further evidence as to the probably at times deciduous character of the horns in the Merycodontini is presented under that section.)

Historical

The first notice in the literature of any of the Tertiary forms here under consideration is Leidy's description of *Leptomeryx* in 1853, which was followed by Leidy's descriptions of *Merycodus* in 1854 and of *Cosoryx* in 1869. Foremost among the discussions of the affinities and broader taxonomic problems of the American Cervidæ, Antilocapridæ, Protoceratidæ and Hypertragulidæ are those of Edward D. Cope, William B. Scott and William D. Matthew. Cope (1874) suggested that *Cosoryx* Leidy was the ancestor of the Cervidæ, and subsequently (1877) remarked:

"It is not probable that this genus is the immediate ancestor of *Cervus*, from the fact that the molar teeth display in their prismatic form a higher degree of specialization than belongs to that genus. It is probable that the true ancestor combined the dental type of *Cervus*, with the distinct roots and short crowns of the molars, with the type of horns [of *Cosoryx*] . . . [The] molars [of *Dromomeryx borealis*] differ from those of [*Cosoryx*] much as those of the deer differ from the molars of the antelope. While [*Cosoryx*] was probably the ancestor of *Antilocapra*, *Blastomeryx* was the ancestor of *Cervus* or *Cariacus*." (*Dromomeryx* Douglass had not then been described and Cope uses *Blastomeryx* for both *Dromomeryx borealis* and *Blastomeryx gemmafer*.)

Matthew (1908) observes *Blastomeryx* "... proves to be a very primitive deer, approximately ancestral to the American Cervidæ, and derivable in its turn from the Oligocene genus *Leptomeryx*, whose relationship to the Cervid phylum had not been suspected. We are thus enabled to trace the ancestry of the American Cervidæ back to the Oligocene, by successive stages known from the entire skeleton, and not merely from the inadequate evidence of teeth and jaws... The fossil species in successive levels in the same locality will show usually successive approximations toward the next higher generic stage. But all are approximately, not exactly, in genetic succession ... we are dealing usually with an approximate, not an exact phyletic series... With this reservation ... I believe that we can trace the ancestry of the American Cervidæ back to *Leptomeryx*... *Camelomeryx* [of the Uinta] cannot be directly ancestral to *Leptomeryx*, and I suspect that if it is ancestral to any of the Hypertragulidæ its affinities are rather with *Heteromeryx*..."

A list of the previously described genera and respective genotypic species of the Cervidæ, Antilocapridæ, Protoceratidæ and Hypertragulidæ, arranged according to the dates of description, recalls many interesting dissertations on these forms. Twenty-three genera have heretofore been described from the Tertiary and three from the Pleistocene. Of these, nine represent the Cervidæ, eight the Antilocapridæ, four the Protoceratidæ and five the Hypertragulidæ. The Quaternary Bovidæ include in addition some eight extinct and four Recent genera and subgenera, the:

EXTINCT: *Boötherium* Leidy (1852), *Euceratherium* Furlong and Stock (1904), *Preptoceras* Furlong (1905), *Symbos* Osgood (1905), *Neotragocerus* Matthew and Cook (1909), *Superbison* Nobis (1930), and newly reported *Saiga* and *Poëphagus*; RECENT: *Oreamnos*, *Ovis*, *Ovibos*, *Bison*.

PRESENT FAMILY REFERENCE	GENERA AND DATE OF DESCRIPTION	GENOTYPIC SPECIES
TERTIARY		
Hypertragulidæ.....	<i>Leptomeryx</i> Leidy, 1853	<i>L. evansi</i> Leidy
Antilocapridæ.....	<i>Merycodus</i> Leidy, 1854	<i>M. necatus</i> Leidy
Antilocapridæ.....	<i>Cosoryx</i> Leidy, 1869	<i>C. furcatus</i> Leidy
Hypertragulidæ.....	<i>Hypisodus</i> Cope, 1873	<i>H. minimus</i> Cope
Hypertragulidæ.....	<i>Hypertragulus</i> Cope, 1874	<i>H. calcaratus</i> Cope
Cervidæ.....	<i>Blastomeryx</i> Cope, 1877	<i>B. gemmifer</i> Cope, 1874
Protoceratidæ.....	<i>Protoceras</i> Marsh, 1891	<i>P. celer</i> Marsh
Protoceratidæ.....	<i>Calops</i> Marsh, 1894	<i>C. cristatus</i> Marsh
Protoceratidæ.....	<i>Syndyoceras</i> Barbour, 1905	<i>S. cooki</i> Barbour
Hypertragulidæ.....	<i>Heteromeryx</i> Matthew, 1905	<i>H. dispar</i> Matthew
Hypertragulidæ.....	<i>Allomeryx</i> Sinclair, 1905	<i>A. planiceps</i> Sinclair
Antilocapridæ.....	<i>Sphenophalos</i> Merriam, 1909	<i>S. nevadanus</i> Merriam
Antilocapridæ.....	<i>Illogoceros</i> Merriam, 1909	<i>I. alexandræ</i> Merriam
Cervidæ.....	<i>Dromomeryx</i> Douglass, 1909	<i>D. borealis</i> (Cope), 1878
Cervidæ.....	<i>Drepanomeryx</i> Sinclair, 1915	<i>D. falciformis</i> Sinclair
Cervidæ.....	<i>Cranioceras</i> Matthew, 1918	<i>C. unicornis</i> Matthew
Cervidæ.....	<i>Aletomeryx</i> Lull, 1920	<i>A. gracilis</i> Lull
Hypertragulidæ.....	<i>Nanotragulus</i> Lull, 1922	<i>N. loomisi</i> Lull
Cervidæ.....	<i>Machæromeryx</i> Matthew, 1926	<i>M. tragulus</i> Matthew
Protoceratidæ.....	<i>Synthetoceras</i> Stirton, 1932	<i>S. tricornatus</i> Stirton
Antilocapridæ.....	<i>Proantilocapra</i> Barbour-Schultz, '34	<i>P. platycornea</i> B. and S.
Protoceratidæ.....	<i>Pseudoprotoceras</i> Cook, 1934	<i>P. longinarius</i> Cook
Antilocapridæ.....	<i>Ceratomeryx</i> Gazin, 1935 ¹	<i>C. prenticei</i> Gazin
PLEISTOCENE		
Cervidæ.....	<i>Cervalces</i> Scott, 1885	<i>C. scotti</i> (Lydekker), '98
Antilocapridæ.....	<i>Capromeryx</i> Matthew, 1902	<i>C. furcifer</i> Matthew
Antilocapridæ.....	<i>Tetrameryx</i> Lull, 1921	<i>T. shuleri</i> Lull

The section of the present report dealing with the American Tertiary Cervidæ originally was suggested through the discovery of a beautifully preserved skull and mandible of a three-horn-pediced deer, and the realization that this represented the long-questioned genus, *Cranioceras*. Later it was decided to include in the one report both the Cervidæ and Antilocapridæ, as the inclusion of the latter would be facilitated through the preliminary studies previously undertaken by Martha Frick on the extensive collections of Merycodontine horns from New Mexico. Then, with the purpose of covering all of the so-far-known horned Ruminantia of the American Tertiary-Quaternary, the chapters on the Bovidæ and Protoceratidæ were added.² Since the manuscript was consigned to the press, one unexpected discovery has followed another and these have permitted many additions to, and amplifications and corrections of, the original text and figures.

¹ And more recently the Cervid, *Pediomeryx* Stirton, 1936, genotypic species *P. hemphillensis* Stirton.

² To conserve space, a formal bibliography is omitted, as all of the major references to the literature are cited as to volume and page in the synonymies heading the detailed lists of genera, subgenera and species.

The thirty-three new genera and subgenera, and the respective genotypic and subgenotypic species¹ of the Cervidæ, Antilocapridæ and Protoceratidæ (and Camelidæ) described in the present report are:

FAMILY	NEW GENERA AND SUBGENERA	GENOTYPIC ² AND SUBGENOTYPIC SPECIES
Cervidæ.....	<i>Procranioceras</i> , n.subg.	<i>P. skinneri</i>
	<i>Rakomeryx</i> , n.g.	<i>R. raki</i>
	<i>Subdromomeryx</i> , n.subg.	<i>S. scotti</i>
	<i>Bouromeryx</i> , n.subg.	<i>B. milleri</i>
	<i>Barbouromeryx</i> , n.g.	<i>B. trigonocorneus</i> (B. & S.)
	<i>Probarbouromeryx</i> , n.subg.	<i>P. sweeti</i>
	<i>Protobarbouromeryx</i> , n.subg.	<i>P. marslandensis</i>
	<i>Matthomeryx</i> , n.subg.	<i>M. matthewi</i>
	<i>Yumaceras</i> , n.g.	<i>Y. figginsi</i>
	<i>Sinclairiomeryx</i> , n.g.	<i>S. sinclairi</i>
	<i>Procoileus</i> , n.subg.	<i>P. edensis</i>
	<i>Longirostromeryx</i> , n.g.	<i>L. merriami</i>
	<i>Parablastomeryx</i> , n.g.	<i>P. gregorii</i>
	<i>Pseudoparablastomeryx</i> , n.subg.	<i>P. scotti</i>
	<i>Problastomeryx</i> , n.subg.	<i>P. primus</i> (Matthew)
	<i>Pseudoblastomeryx</i> , n.subg.	<i>P. falkenbachii</i>
Antilocapridæ.....	<i>Ramoceros</i> , n.g.	<i>R. osborni</i> (Matthew)
	<i>Paramoceros</i> , n.subg.	<i>P. brevicornis</i>
	<i>Merriamoceros</i> , n.subg.	<i>M. coronatus</i> (Merriam)
	<i>Subcosoryx</i> , n.subg.	<i>S. cerroensis</i>
	<i>Paracosoryx</i> , n.subg.	<i>P. wilsoni</i>
	<i>Subparacosoryx</i> , n.subg.	<i>S. savaronis</i>
	<i>Meryceros</i> , n.g.	<i>M. warreni</i> (Leidy)
	<i>Submeryceros</i> , n.subg.	<i>S. crucianus</i>
	<i>Osbornoceros</i> , n.g.	<i>O. osborni</i>
	<i>Plioceros</i> , n.g.	<i>P. blicki</i>
	<i>Texoceros</i> , n.g.	<i>T. guymonensis</i>
	<i>Stockoceros</i> , n.subg.	<i>S. conklingi</i> (Stock)
	<i>Hayoceros</i> , n.subg.	<i>H. falkenbachii</i>
Protoceratidæ.....	<i>Prosynthetoceras</i> , n.subg.	<i>P. francisi</i>
	<i>Paratoceras</i> , n.g.	<i>P. macadamsi</i>
Camelidæ (in part).....	<i>Pseudoceras</i> , n.g.	<i>P. skinneri</i>
	<i>Rakomylyx</i> , n.g.	<i>R. raki</i>

¹ Six of the new genera and subgenera are based on previously described species.

² As here used, genotype equals the type of the genotypic species, i.e., the genoholotype of Schuchert (1897) of that species; the genotypic species equals the genotype (Schuchert, 1905). The type of the genus as here used is synonymous only with the type of the genotypic species. Confusion and error result through carelessness in this regard.

The type of the species is the original specimen from which the species was first described. In the case of extinct mammals, the genus must be based on the remains of one particular individual. The correctness of reference of a seeming "topotype" (Thomas, per Schuchert, 1905) collected at the exact locality and seemingly from the identical stratum that furnished the type, may be open to serious question.

In the case of the forms of the present volume, the genus or subgenus is used to set apart a form or forms distinguished by some apparently material osteological character or characters; a species or subspecies, to designate areal or vertical distribution when observed characters are of doubtful importance but when the associated forms point to a distinct faunistic phase.

(And see footnote 1, pages, 3, 6, 14 and Merycodont text page 322.)

Tentative Reclassification

(See preceding key to the five families, p. 9)

The here adopted reclassification of the North American Tertiary Cervidæ, Antilocapridæ, Protoceratidæ and Hypertragulidæ, and Quaternary Cervidæ, Antilocapridæ and Bovidæ, based on characters of the teeth and horns, places the included species in thirteen divisions, some twenty-nine subfamilies and seventy-one¹ genera and subgenera—forty-nine from the Tertiary and twenty-two from the Pleistocene-Recent.

There are many complications in attempting to secure a balanced taxonomic arrangement, and to afford proportionate importance to each group relative to the whole, through the greater completeness of knowledge of the membership of certain groups and the paucity or lack of such knowledge regarding other groups. While the Cervidæ and Antilocapridæ are homogeneous families and in the case of certain of their Tertiary branches there is considerable knowledge, the Bovidæ are far from homogeneous and their Tertiary history is, to all practical purposes, unknown. It is hoped that the present revision of the several families, in conjunction with similar studies now in progress on the fossil Camelidæ, Equidæ, Oreodontidæ and Carnivora, may afford a new basis for interpretation of the American Tertiary.

Cranial and dental characters distinguishing the several subfamilies, genera and subgenera of the American

I.—CERVIDÆ

II.—ANTILOCAPRIDÆ

III.—BOVIDÆ

IV.—PROTOCERATIDÆ

V.—HYPERTRAGULIDÆ (and

VI.—CAMELIDÆ, in part)

are given in the six tentative keys of the following pages (compare Figures 2, 2A and 2B and other figures throughout the text):

¹ Total of seventy-nine genera and subgenera are enumerated—see footnote 1, page 2.

I.—CERVIDÆ Gray (1821). BRACHYDONT TO LESS BRACHYDONT

Males with supra-postorbital, solid, bony horn-pedicles (Fig. 2)

DIVISION A.—DROMOMERYCINI. LATE TERTIARY OR MIDDLE TERTIARY...
BRACHYDONT

(Compare European Late Tertiary PALÆOMERYCIDÆ Lydekker, 1883, in part—"not deciduous"?)

Premolars tending large; /ms with "Palæomeryx" fold; diastema moderate; horn-pedicles elongate-tending, supra-postorbital, occasionally with basal flange (probably skin-covered and bearing deciduous horny caps or antlers); occiput variably produced.

Pedicles tall, erect and slightly
compressed laterally; occiput
strongly produced.....

Subfamily 1.—CRANIOCERATINÆ

(Median occipital appendage)

p₄ open.....I.—*Cranioceras* Matthew

(Less brachyodont, premolars smaller)

p₄ tending closed....IA.—*Procranioceras*, n.subg.

(Brachyodont, premolars larger)

Pedicles tall, directed anteriorly,
bowed; tendency to basal post-
orbital flange and closed p₄....

Subfamily 2.—DROMOMERYCINÆ

Pedicles strongly bowed,
flange slight (p₄ may be open)...II.—*Rakomeryx*, n.g.

Pedicles moderately bowed,
basal flange heavy; p₄ closed...III.—*Dromomeryx* Douglass

IIIA.—*Subdromomeryx*, n.subg.
(Smaller)

Pedicles erect, curving an-
teriorly; moderately short; cross
section triangular; p₄ open.....

Subfamily 3.—BARBOUROMERYCINÆ

IV.—*Bouromeryx*, n.subg.(Middle Tertiary)...V.—*Barbouromeryx*, n.g.".....VA.—*Probarbouromeryx*, n.subg.

".....VB.—*Protobarbouromeryx*, n.subg.
(Premolars reduced)

Pedicles tall, directed poste-
riorly, slightly twisted; post-
orbital flange rudimentary; p₄
open.....

Subfamily 4.—DREPANOMERYCINÆ

VI.—*Drepanomeryx* SinclairPedicle slender proximally and ex-
panded distallyVII.—*Matthomeryx*, n.subg.

Pedicle heavier and narrowed distally

DIVISION B.—ALETOMERYCINI. LATE TERTIARY OR MIDDLE TERTIARY.....LESS
BRACHYDONT TO SUBHYPSODONT

Premolars much reduced; "Palæomeryx" fold absent; diastema consider-
able; horn-pedicles without flange.

Size large; pedicles tall, cross
section round; p_4 closed molari-
form.....

Subfamily 5.—YUMACERATINÆ

VIII.—*Yumaceras*, n.g.

Size small to moderate; pedicles
moderate to tall, cross section
triangular; p_4 open.....

Subfamily 6.—ALETOMERYCINÆ

(Compare European *Cervulus* Solater
and *Dicrocerus* Lartet)

Pedicles erect.....IX.—*Aletomeryx* Lull (Middle Tertiary)
(Nasals medium-sized)

Pedicles bent forward.....X.—*Sinclairiomeryx*, n.g.
(Nasals elongate and with bosses)

Males with postorbital, solid, bony pedicles

DIVISION C.—CERVINI. PLEISTOCENE-RECENT.....LESS BRACHYDONT
(CERVIDÆ Gray, 1821, in part.)

Horn-pedicles moderate, and capped with variably shaped antlers; pre-
molars tending large and diastema moderate.

p_2 open, p_4 usually closed, /ps
moderate; diastema moderate;
metacarpals tending long.....

Subfamily 7.—CERVINÆ ("Plesiometacarpalia")

(?)XI.—*Procoileus*, n.subg.
(Eden Uppermost Pliocene)

Pedicle directed out and up-
ward. Frontoparietal suture
slightly concave.....

XII.—*Cervus* Linnæus (1758)
(Posterior nares undivided)

Subfamily 8.—ODOCOILENÆ ("Telemetacarpalia," in part)

Pedicle well posterior of orbit
and projecting posteriorly.
Frontoparietal suture deeply
concave.....

XIII.—*Odocoileus* Rafinesque (1832)
and *Eucervus* Gray (1866)
(Posterior nares divided)
(?)*Sangamonæ* Hay

p_2 and p_4 tending closed, col-
umns detached, and /ps large
relative to /ms; diastema long;
metacarpals tending shorter....

Subfamilies 9—9a.—ALCENÆ-RANGIFERINÆ
("Telemetacarpalia," in part)
(RANGIFERIDÆ Brooke, 1828)

XIV.—*Cervalces* Scott (1885)

Pedicle adjacent to orbit and
projecting laterally. Fronto-
parietal suture straight.....

XV.—*Alces* Gray (1821)
(Nasals abbreviated; posterior nares
undivided)

Pedicle erect and, like orbit,
markedly posterior. Fronto-
parietal suture very deeply con-
cave.....

XVI.—*Rangifer* Hamilton Smith (1827)
(Female with rudimentary horn-
pedicles; posterior nares divided)

[South America.....Subfamilies 8 and 9a (cont.).—ODOCOILE-
(Tentatively, for compari-
son—unstudied.)

XVII.—*Pudu* Gray
Spike-horned

XVIII.—*Hippocamelus* Leuckart
Single-forked antlers

XVIII.A.—*Blastocerus* Wagner
Anterior beam biforked,
posterior shaft triforked.

XIX.—Including *Mazama* Rafinesque,
and extinct *Ozotoceros* Ame-
ghino, *Palæoodocoileus* Spill-
mann, *Paraceros* Ameghino,
Morenelaphus Carette and
Antifer Ameghino]

Males typically without pedicles or horns

DIVISION D.—BLASTOMERYCINI. MIDDLE OR LATE TERTIARY. BRACHYDONT
TO SUBHYPSODONT

[Compare Eurasiatic Recent *Moschus* Linnæus (1758) and Tertiary
Micromeryx Lartet (1851).]

Late Tertiary

Manus normal

Diastema very long (top of cra-
nium unknown; (subhypsodont. Subfamily 10.—LONGIROSTROMERYCINÆ

XX.—*Longirostromeryx*, n.g.
Premolars reduced

XXI.—*Blastomeryx* Cope
Diastema more moderate, premolars
normal to large

Diastema moderate to short;

brachyodont.....Subfamily 11.—PARABLASTOMERYCINÆ

XXII.—*Parablastomeryx*, n.subg.
Diastema tending short, premo-
lars large

XXIIA.—*Pseudoparablastomeryx*, n.subg.
Diastema very short

Middle Tertiary

(See above).....Subfamily 10.—LONGIROSTROMERYCINÆ
(cont.)

XXIII.—*Machæromeryx* Matthew
Premolars tending moderate

(See above).....Subfamily 11.—PARABLASTOMERYCINÆ
(cont.)

XXIV.—*Problastomeryx*, n.subg.
Premolars moderate

Manus short (?PSEUDOBLASTO-
MERYCINÆ.....

XXV.—*Pseudoblastomeryx*, n.subg.
Premolars large

II.—ANTILOCAPRIDÆ Gray (1866). HYPSONDONT

Males with "horns" distally forked (or so tending). Division—(A) typically burred, (B) burrless.

DIVISION A.—COSORYCINI ("MERYCODONTINI"). LATE TERTIARY
(MERYCODONTIDÆ Matthew, 1904.)

"Horns" typically burred (indeterminate whether horn-pedicles with partially deciduous antlers, or horn-cores with deciduous sheaths):

Postorbital, three- or more-tined "antlers" extending posteriorly and outwardly and presumably partly deciduous.....

Subfamily 1.—RAMOCEROTINÆ

I.—*Ramoceros*, n.g.

Points successive

IA.—*Paramoceros*, n.subg.

Points distal and crotched

IB.—*Merriamoceros*, n.subg.

Small, multi-pointed

Supra-orbital and erect forked

"horns" or horn-cores..... Subfamily 2.—COSORYCINÆ Cope (1889),
in part

Cross section tending:

(a) Circular, shaft slender..... II.—*Cosoryx* Leidy (1869)

Diastema and premolars moderate

IIA.—*Subcosoryx*, n.subg.

Diastema moderate, premolars greatly reduced

IIB.—*Paracosoryx*, n.subg.

Diastema abbreviated, premolars moderately heavy

(b) Compressed, shaft relatively heavy.....

III.—*Meryceros*, n.g.

Muzzle and diastema elongate

IIIA.—*Submeryceros*, n.subg.

Small, forks individually burred

DIVISION B.—ANTILOCAPRINI. LATE TERTIARY-PLEISTOCENE OR RECENT

Horn-cores typically forked (always burrless), supra-orbital, sheaths deciduous (or so tending).

Late Tertiary

Horn-cores long, twisted..... Subfamily 3.—ILINGOCEROTINÆ

Posteriorly directed; basal

cross section crescent-shaped... IV.—*Osbornoceros*, n.g.

(No indication of forking)

Erect, spiraled; basal cross

section oval-tending..... V.—*Ilingoceros* Merriam

(Forked in immaturity)

(?VA.—*Sphenophalos* Merriam)

Late Tertiary (cont.)

Horn-cores short, transversely flattened and forked or unforked:

Forked..... Subfamily 4.—*PLIOCEROTINÆ*

Core base erect, flattened ter-

minal points short..... VI.—*Plioceros*, n.g.Subfamily 5.—*STOCKOCEROTINÆ* (in part)

Core base moderate, forks

long..... VII.—*Texoceros*, n.g.Unforked, blade-like..... Subfamily 6.—*ANTILOCAPRINÆ*

Basal cross section triangular,

small..... VIII.—*Proantilocapra* Barbour and
Schultz

Tertiary to Recent

Core compressed, dagger-like,

larger..... XIII.—*Antilocapra* Ord (1818)¹
Sheath forked

Pleistocene

Forked..... Subfamily 5.—*STOCKOCEROTINÆ* (cont.)

Core base deeply cleft and forks either:

Subequal..... IX.—*Stockoceros*, n.subg.

Unequal:

Posterior branch largest... X.—*Capromeryx* Matthew (1902)¹Posterior branch forwardly directed
(size small)XI.—*Tetrameryx* Lull¹Posterior accessory branch divergent
and tall, cross section oval-roundedAnterior branch largest... XII.—*Hayoceros*, n.subg.(And note *Ceratomeryx* Gazin.)Anterior or main branch enlarged,
flattened (equivalent to core of
Antilocapra) and divergent posterior
branch of oval-rounded cross section
(sheath possibly three-pronged)

¹ "*Caproceros*," "*Tetramoceros*" and the *Dicranoceros* Hamilton Smith (1827) might have been preferable to *Capromeryx*, *Tetrameryx* and *Antilocapra*.

III.—BOVIDÆ Gray (1821). HYPsODONT TO SO-TENDING

(American Quaternary "Cavicornia" probably largely of Eurasiatic derivation)

Both sexes with hollow horn-cores having permanent sheaths; with possible exception of *Neotragocerus*, unrepresented from American pre-Quaternary. Heavy, short-tending metapodials, distal splints absent (lateral phalanges tending absent or represented by hooves).

Horns straight to slightly curved:

DIVISION A.—ANTILOPINI

Subfamily 1.—ANTILOPINÆ (in part)

Nasals normal....(?) I.—*Neotragocerus* Matthew and Cook (1909). (?Late Tertiary)

II.—*Oreamnos* Rafinesque (1817)

Nasals abbreviated... III.—*Saiga* Gray (1843)

Horns revolute or so-tending:

DIVISION B.—OVINI

Subfamily 2.—EUCERATHERINÆ

IV.—*Euceratherium* Furlong and Sinclair (1904)

V.—*Preptoceras* Furlong (1905)

(Horn bases taller)
(*Aftonius* Hay and *Taurotragus* ref.
Gidley, questioned)

Subfamily 3.—OVINÆ Baird (1857),
in part (and OVICAPRINÆ Noack, 1887,
in part)

VI.—*Ovis* Linnæus (1758)

Subfamily 4.—OVIBOVINÆ Gill (1872)

Nasals shorter..... VII.—*Ovibos* Blainville (1816)

(*Liops* Gidley and *Gidleya* Cossmann)

Nasals longer..... VIII.—*Symbos* Osgood (1905)

IX.—*Bootherium* Leidy (1852)

(Horns slender, less depressed and
more spreading)

DIVISION C.—BOVINI

Subfamily 5.—BOVINÆ

X.—*Bos* Linnæus (1758), in part—*Poëphagus* Gray (1843)
(Horns slender, elongate)

XI.—*Bison* H. Smith (1827)
(Horns heavy, cores shorter)

XII.—*Superbison* Nobis (1930)
(Horns heavy, cores longer)

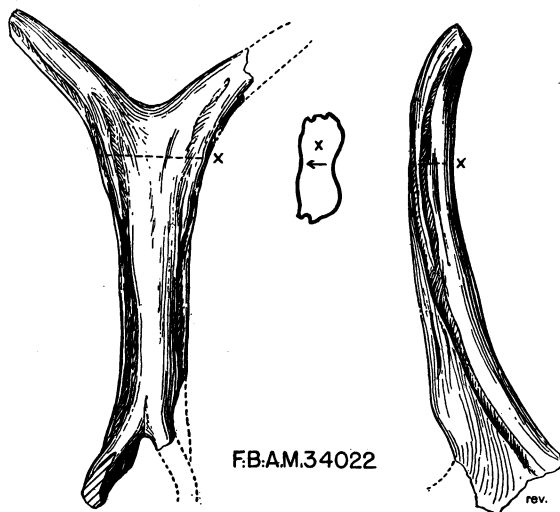


FIG. 2C. F.B.A.M. 34022, *Prosynthetoceras siouxensis dawesensis*, n. subsp., type, from Dawes County, Nebraska.
 × $\frac{1}{4}$. Anterior and lateral (rev.) views. x, cross section. (See page 607.)

IV.—PROTOCERATIDÆ Marsh (1891). BRACHYDONT TO SUBHYPSODONT

Males with variable cranial armament; nasals abbreviated; bullæ small; metacarpals short and detached (laterals generally retained).

THE PROTOCERATINI. LATE TERTIARY OR MIDDLE TERTIARY.

p_1^1 absent

Late Tertiary

Diastema long.....Subfamily 1.—SYNTHETOCERATINÆ

Paired postorbital and consolidated rostral "horns":

p_2^2 lost, crowns subhypsodont...I.—*Synthetoceras* Stirton (1932)

p_2^2 present, crowns brachyodont.....II.—*Prosynthetoceras*, n. subg.

p_1^1 retained

Middle Tertiary

Diastema and premolars moderate.....Subfamily 2.—SYNDYOCERATINÆ

Paired postorbital and paired rostral "horns":

IV.—*Syndyoceras* Barbour (1905)

Late Tertiary or Middle Tertiary

Diastema short and premolars large.....Subfamily 3.—PROTOCERATINÆ

Late Tertiary.....V.—*Paratoceras*, n. g.
 (Cranium unknown)

Middle Tertiary (smaller).....VI.—*Protoceras* (and *Calops*) Marsh
 (1891)

V.—HYPERTRAGULIDÆ Cope (1879). BRACHYDONT OR HYPSONDONT. MIDDLE TERTIARY

Males hornless; nasals normal; bullæ inflated; four detached metacarpals (in *Leptomeryx* and *Nanotragulus*).

BRACHYDONT

DIVISION A.—LEPTOMERYCINI. (SIZE SMALL)

p_2 in series, premolars large, p_4 Cervid-formed.....Subfamily 1.—LEPTOMERYCINÆ

Oligocene

I.—*Leptomeryx* Leidy (1853)

II.—*Heteromeryx* Matthew (1905)

DIVISION B.—HYPERTRAGULINI.

p_2 tending detached, p_3 unicuspid...Subfamily 2.—HYPERTRAGULINÆ
Premolars:

Oligocene

(a) Reduced.....III.—*Hypertragulus* Cope (1874)
III.A.—*Allomeryx* Sinclair (1905)

or

(b) More reduced and Lower Miocene
crowns taller.....IV.—*Nanotragulus* Lull (1922)
(*Pes* tetradactyl)

HYPSONDONT

DIVISION C.—HYPISONDONTINI. (SIZE DIMINUTIVE)

p_1 adjoining /C, p_2 tending detached (or lost), /ps reduced.....Subfamily 3.—HYPISONDONTINÆ

Oligocene

V.—*Hypisodus* Cope (1873)
(Laterals retained in *pes*)

[APPENDIX—VI].—CAMELIDÆ (in part). BRACHYDONT TO HYPSONDONT

Hornless; premolars compressed laterally.

BRACHYDONT

DIVISION A.—PSEUDOCERATINI.

Diastema short.....Late Tertiary....Subfamily 1.—PSEUDOCERATINÆ

I.—*Pseudoceras*, n.g.

(Condition of C/, p^1 and cranium unknown)

HYPSONDONT

DIVISION B.—STENOMYLINI.

Diastema tending short.....Subfamily 2.—STENOMYLINÆ

Late Tertiary....II.—*Rakomylus*, n.g.

Premolars (?) absent

Middle Tertiary...III.—*Stenomylus* Peterson (1906)

Premolars reduced

FAMILY I.—CERVIDÆ

The vanished deer forms of Middle Tertiary to Quaternary America are referred, in the present volume, to the four divisions:

DROMOMERYCINI, Late Tertiary

ALETOMERYCINI, Middle Tertiary and early Late Tertiary

CERVINI, Quaternary,¹ and

BLASTOMERYCINI, Middle Tertiary and Late Tertiary.

Reconstructions of the heads of several of the more outstanding of the extinct genera are shown in the frontispiece (in part) and Figures 1, 2D and 19. The Dromomerycini include a number of moderate to large forms with curiously specialized crania and horn-pedicles. The dentition is more generalized than in *Aletomeryx*. *Palæomeryx* Meyer and *Dicrocerus* Gervais of the European Tertiary may prove to represent the Dromomerycini division. *Aletomeryx*, in taller-crowned molars and reduced premolars, is more specialized than the later appearing Dromomerycini, and in the reduction of the premolars is more advanced than the Recent Cervini. The male *Aletomeryx*, in enlarged upper canines and tall horn-pedicles, parallels the Asiatic muntjac (*Cervulus*). The Blastomerycini include brachyodont and less brachyodont forms of moderate to small size. The male Blastomerycini, in sabre-formed canines and in lack of horn-pedicles, are suggestive of the musk deer (*Moschus*) of Asia. *Blastomeryx* and *Micromeryx* of the European Tertiary are possibly related. In the general Introduction (and Key) the cranial, dental and horn-pedicle characters of these early American Cervids have been discussed in comparison with the family, Antilocapridæ. The three-page table gives the so-far-recognized distribution of the genera, subgenera and species. The four divisions are taken up in detail in the following pages, the genera and species appearing under the numbers shown in the table.

In several instances, closely allied Dromomerycini forms suggest progression.—This is exemplified in the case of the three-horn-pediced *Cranioceras* group, by the smaller horn-pedicles and molars, more brachyodont crowns and larger premolars of *Procranioceras skinneri* from Devil's Gulch, as compared to *Cranioceras granti* from the definitely later accumulations of Kat and *Leptarctus* Quarries, Nebraska. It is exemplified again, though less markedly, in the Dromomerycini by the larger size of the very similarly formed horn-pedicles and dentition of the Late Tertiary *Subdromomeryx*, as compared to the Middle Tertiary *Probarbouromeryx* and *Barbouromeryx*; the larger size of *Dromomeryx* as compared to its Late Tertiary contemporary *Subdromomeryx*; and the greater molariformity of the p_4 of *Dromomeryx* (and *Subdromomeryx*) as contrasted with that of *Barbouromeryx*.

¹ The Eastern Divisions, Cervulini and Moschini, are unrecognized in America.

TABLE I

CREVID GENERA, SUBGENERA AND SPECIES OF THE AMERICAN MIDDLE AND LATE TERTIARY—OCCURRENCE AND TOTALS OF AVAILABLE SPECIMENS (Roman and arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in () from type, and in [] from other than type area for the particular species.) (See Introduction, page 7.)

	LATE TERTIARY		MIDDLE TERTIARY	
	Uppermost	Specimen Count	Genus Number	Specimen Count
A.—DROMOMERYCINI	Eden, Calif.			
	Hemphill Co., Tex. (& *Guy-			
	mon, Okla.)			
	Yuma Co., Colo.			
	Lepi., *Kat, †Xmas, †B. C., †Q. & †U. Snake Cr., Nebr.;			
I, IA	Clarendon (& *Navasota), Tex.; & †Kans.			
	Barstow, Calif.			
	Mascall (& *Skull Spring), Oreg.			
	Virgin Valley, Nev.			
	Santa Fé, N. Mex.			
II	Pawnee Cr., Colo.			
	Burge (& *Midway), Nebr.			
	Crookston equiv. (& *Devil's Gulch), Nebr.			
	L. Snake Cr. (& *Dawes Co.), & †Sheep Cr., Sioux Co., Nebr.			
	Mont. (& *S. Dak.)			
III, IIIA				
Cranioceras & Procranioceras	†? [1] (1a) *†§ [1a]	(7) *? (7a)	(1) * (4) (1) *? [3a] (4a)	
		(1) (2) (3)		
Rakomeryx, n.g.				
Dromomeryx Douglass				
Subdromomeryx				

(Continued on next page)

TABLE I—Continued. [The column headings are the same as on the preceding page.]

[illegible]



FIG. 2D. Rak's Deer, from Barstow, California.

Rakomeryx raki, n.g. and sp.

Reconstruction $\times$ approximately $\frac{1}{2}$. (See page 99.)

DIVISIONS A.—DROMOMERYCINI, AND B.—ALETOMERYCINI

Frontispiece, D-E, and Figures 1A-E, 2D (Reconstructions), 3 (in part) (Deciduous Dentitions), 2, 2A (in part) and 11-16B (Skulls, Horn-Pedicles and Mandibles), 4-4A (in part) and 5-9, 15A (Mandibular Dentitions), 4A (in part) and 10-10A (Maxillary Dentitions), 17-18 and (in part) 25-25B (Limbs)

DISCUSSION

The Dromomerycine and Aletomerycine divisions of the Cervidæ (reconstructions, frontispiece, D-E, and Figs. 1, 2D) here are considered as embracing some six subfamilies of fourteen horned genera and subgenera of the later Tertiary of North America. They have the general characters of brachyodont to subhypsodont molars; paired postorbital unforked bony horn-pedicles that are more or less forwardly directed and bowed, twisted or basal-flanged; a peculiar prominence of the occiput; and heavy-proportioned limbs of brocket to red deer size. The dentition

of certain of the brachyodont Dromomerycini is very deer-like except for the somewhat broader and lower molar crowns, less compressed and diagonal inner lophs, and more prominently developed accessory folds and cingula. As contrasted to *Antilocapra*, the teeth are low to moderate-crowned and, in the unworn state, rugose; the p^3 is generally elongate anteroposteriorly relative to p^4 ; and the incisors (lower) are relatively short. The American dentitions (see figures) have many of the characters of the Palæomerycinæ of the European Late Tertiary. (In none of the species of *Palæomeryx*, unfortunately, has the form of the skull or the form of the horn-pedicle been determined.) In Division A, the brachyodont Dromomerycini, the anterior and posterior cingula or shelves, intervalley tubercles and external styles are usually well developed. The lower molars are provided with a "Palæomeryx" fold and an anterior shelf of somewhat "Auchenia" pattern, and the opposed median edges of the inner crescents of the unworn maxillary series exhibit crotchets. In *Dromomeryx* the posterior molars are proportionately enlarged relative to the premolars, and the p_4 is somewhat molariform. In Division B, the subhypsodont Aletomerycini, the teeth are longer-crowned, the cingula and folds less developed and the premolars typically reduced. The proportions of the premolars relative to the molars, and of p_2 relative to p_3 , and the form and pattern of the p_3 and p_4 tend to differ in moderate degree throughout the several genera and subgenera. As seen in the limbs, the stature varied in the two divisions from the brocket-sized *Aletomeryx* to the large red-deer-sized *Yumaceras*. The data as to the limbs are discussed and figured on a later page (see 169). Lateral phalanges and metacarpals II and V, or their splints, may be retained.

The longest Dromomerycini-Aletomerycini cheek tooth series (*D. whitfordi*, 113 mm.) measures twice the length of the shortest (*A. gracilis*, 55.5 mm.). The length of the series in different individuals of the same species may vary up to 13%. The proportion of the moderately worn m_1/m_3 varies from 81% in *Parablastomeryx gregorii* to 58% in *Bouromeryx pseudonebrascensis* and in *Matthomeryx matthewi*. The dp_1 is not developed in *Cranioceras* and *Procranioceras*; it is present in *Dromomeryx*, *Rakomeryx*, *Subdromomeryx*, *Bouromeryx*, *Aletomeryx*, *Sinclairomeryx* and *Matthomeryx*. As yet its condition is unknown in *Barbouromeryx*, *Probarbouromeryx*, *Protobarbouromeryx*, *Drepanomeryx* and *Yumaceras*.

Eight of the fourteen here recognized American Dromomerycine-Aletomerycine genera and subgenera are represented by crania. Knowledge of five is confined to the horn-pedicles and referred dentitions and of

one to the dentitions alone. Hypothetical reconstructions of the heads in the flesh of *Cranioceras*, *Procranioceras*, *Rakomeryx*, *Dromomeryx*, *Drepanomeryx*, *Matthomeryx*, *Aletomeryx* and *Sinclairiomeryx* are shown in the aforementioned figures (see frontispiece, D-E, and Figs. 1, 2D). Outstanding examples of crania, dentitions and limbs are comparatively illustrated in Figures 5-18 and (in part) 3, 4-4A, 25-25B. The Dromomerycini (with the exception of certain small Barbouromerycines of the Middle Tertiary) appear suddenly and unheralded in the Late Tertiary. The Aletomerycini are known in a number of closely allied and already specialized forms from the Middle and early Late Tertiary, and by the larger and widely differing group from the Uppermost Tertiary. *Aletomeryx* is suggestive of a higher-crowned, smaller-premolar and taller-horn-pediced *Barbouromeryx*, and *Yumaceras*, of a somewhat similarly advanced *Dromomeryx*.

It may be recalled that *Cranioceras* and *Drepanomeryx* formerly were referred to the Bovidae, and *Aletomeryx* to the Antilocapridae. The homology of the Dromomerycine "horn" and the Cervine horn-pedicle previously has not been recognized.

A brief résumé of the characters of the six subfamilies and fourteen genera and subgenera of the Dromomerycini and Aletomerycini is given below. The respective species, their synonymy, type specimens and referred remains are discussed in order in the following pages.

DIVISION A.—DROMOMERYCINI

SIZE GROUPS¹

1. Cranioceratinae II TO III. . . . I. *Cranioceras* Matthew (1918)
IA. *Procranioceras*, n.subg.
2. Dromomerycinae II TO V. . . . II. *Rakomeryx*, n.g.
III. *Dromomeryx* Douglass (1909)
IIIA. *Subdromomeryx*, n.subg.
3. Barbouromerycinae . . . III TO VI. . IV. *Bouromeryx*, n.subg.
V. *Barbouromeryx*, n.g.
VA. *Probarbouromeryx*, n.subg.
VB. *Protobarbouromeryx*, n.subg.
4. Drepanomerycinae II TO III. . VI. *Drepanomeryx* Sinclair (1915)
VII. *Matthomeryx*, n.subg.

¹ The size groups are based on the lengths of m₁-m₃; the smallest size group (vi-) of the Dromomerycini-Aletomerycini is slightly larger than the largest size group (iii+) of the Blastomerycini.

¹ There were those who believed the specimen to represent "... probably part of an ulna, possibly from a rhinoceros." (Cook, H. J. and M. C., 1933, Nebr. Geol. Surv., Paper No. 5, p. 57.)

of the male is of rounder cross section, more posteriorly directed and longer. A cranium and partial cranium from the higher level indicates that in the female the supra-orbital horns were absent and the cranial horn retained only in a greatly reduced state (Fig. 12). The new evidence has been received as the present pages were coming through the press, preventing the inclusion of all the specimens within the text. *Cervulus sinclairi* was based by Matthew (1918) on Snake Creek rami which, in part at least, seem referable to *Cranioceras*. Through present knowledge of the genus it would seem that the fragmentary paired horn-pedicles from the Santa Fé marls, described and figured by Cope (1877) under *Dicrocerus teres*, pertain to *Cranioceras* or to a closely allied form. Joseph Rak's ten years' collections from the New Mexican deposits embrace several ramal dentitions of approximate form. The John C. Blick Pawnee Creek series include a typical horn-pedicle. The new Clarendon collection contains several supra-orbital horn-pedicles and one occipital horn.

In *Cranioceras* the p_4 fossettes are open; the p_2 - p_4 tend to be larger versus the m_1 - m_3 , and the diastema to be slightly longer than in *Dromomeryx*. The northern and southern Nebraska, New Mexico, Colorado and Texas specimens, pending further evidence, are held apart under geographic species. *Cranioceras teres* (Cope) has precedence. It is important to note that the premolar proportions and even the p_4 pattern at times vary among different specimens from the same locality. Certain mandibular dentitions which are intermediate to *Cranioceras* and *Bourromeryx* are referred tentatively to a separate species of the latter. *Cranioceras* reconstruction, Fig. 1B; *Procranioceras*, frontispiece, E.

II. *Rakomeryx*, new genus, introduces a remarkable form from the Mojave Desert of California. The genus is at once characterized by the forwardly directed and laterally bowed supra-orbital horn-pedicles that retain a trace of the basal *Dromomeryx* flange. A large series of referred dentitions from the same Barstow beds are noticeable for the proportionate slenderness of the premolars and particularly for the small proportions of the p_2 . A partial and hornless skull, apparently representing the female, exhibits the characteristic *Dromomeryx* projection of the occiput. The premolars perhaps tend to be more reduced relative to the molars, the p_4 to lack the usual enlargement of the internal median column and the diastema to be shorter than in the more typical members of this division. Remains from Oregon and Nevada are referred to the genus. Reconstruction, Fig. 2D.

III. *Dromomeryx* Douglass is characterized by tall, paired horn-pedicles with strong forward tilt and prominent basal wings. The dentition is typified by the moderate size of the premolars relative to the molars, the retention in the calf of dp_1 , and the closed anterior fossette of p_4 . The genus is already well known through the papers of Cope, Scott and Douglass. The range, Montana and Nebraska, has been extended by our field parties to Colorado. What appears to be a small edition of the genus is seen in *Subdromomeryx*, n.subg., from Montana and Nebraska. Two ramal dentitions exhibit p_4 s with formed anterior fossettes typical of *Dromomeryx* proper. Reconstruction, Fig. 1c.

IV, *Bouromeryx*, new subgenus, V, *Barbouromeryx*, n.g., VA, *Probarbouromeryx*, n.subg., and VB, *Protobarbouromeryx*, n.subg. *Barbouromeryx*, n.g., from the Middle Tertiary of Nebraska, is nicely exemplified in the genotype, *B. trigonocorneus*, partial skull, mandible and skeletal elements of the University of Nebraska collection. The genus is characterized by relatively small general size, shortness of horn-pedicles, extremely brachyodont dentition, large premolars, p_4 fossette unformed and usual "Palæomeryx" folds. *Protobarbouromeryx*, n.subg., from the same Middle Tertiary, differs from *Barbouromeryx* in the smaller proportions of its premolars. Under *Bouromeryx*, n.subg., are grouped several species from the Late Tertiary of Nebraska, Montana and Colorado. As at present known, the mandibular dentitions of certain of these forms somewhat resemble *Cranioceras*; others differ from *Barbouromeryx* mainly in larger size. As glimpsed in the lower dentition, *Barbouromeryx* might lie near to the direct ancestral line of *Bouromeryx* and the more conservative of the Late Tertiary Dromomerycini. Similarly *Protobarbouromeryx*, with reduced premolars, and the contemporary but taller-crowned and still smaller-premolared *Aletomeryx* might represent—the one a more conservative and the other a more progressive Middle Tertiary descendant of still earlier and yet unknown *Probarbouromeryx*-like ancestors.

VI. *Drepanomeryx* Sinclair is noteworthy for the superficial resemblance of its horn-pedicle to the antler of the fallow deer. Unfortunately this genus, as seen in the single so-far-known horn-pedicle of the type specimen from Sioux County, Nebraska, is as yet very much of an enigma. The pedicle retains a bare suggestion of the basal flange so generally characteristic of the Dromomerycine group. It is possible that two partial crania from the type area, which are peculiar in the

strongly posterior position of the orbit, may represent the same genus. One of the two specimens is hornless save for a small excrescence on the posterior border of the orbit, and may have been a female. Reconstruction, Fig. 1E. VII. *Matthomeryx*, new subgenus, exemplified by a cranial saddle bearing large, twisted and inwardly bowed horn-pedicles and by mandibular rami from Dawes County, Nebraska, may have belonged to quite a distinct group or to one fairly closely allied to the curious *Drepanomeryx*. The horn-pedicles are directed posteriorly as in the latter, versus anteriorly in *Dromomeryx*. *Matthomeryx* reconstruction, Fig. 1D.

The three remaining genera, *Yumaceras*, *Aletomeryx* and *Sinclairiomeryx*, are proportionately taller-crowned than the preceding. The *Yumaceras* and *Sinclairiomeryx* remains are derived from the Late Tertiary. The *Aletomeryx* remains come from horizons which at present are correlated with the Lower Miocene or Middle Tertiary. In their subhypsodonty, missing "Palæomeryx" fold and moderate to notably small-proportioned premolars, the three forms afford definite evidence of early specialization on the part of certain of the Tertiary Cervids. For convenience, the three genera are assigned to a taller-crowned Division, the Aletomerycini. The shape of the horn-pedicles of the three genera is so widely different that the same might well be referred to three distinct subfamilies.

VIII. *Yumaceras*, new genus, rests on a cranial saddle with partial horn-pedicles from northeastern Colorado. The form of the bony pedicle differs from any so far observed. The genus is believed to be witnessed by fragmentary dentitions from the same area and Texas, and by better-preserved dentitions from Oklahoma, all of which have the common characters of tall tooth crowns and reduced premolars. The Oklahoma dentition might seem to bear much the same relationship to *Dromomeryx* that the *Aletomeryx* dentition does to *Bouromeryx*.

Aletomeryx Lull, with erect, and *Sinclairiomeryx*, n.subg., with peculiar anteriorly bent horn-pedicles, are based, respectively, on crania from the Lower Miocene and later Sheep Creek of Nebraska. In life the horn-pedicles ostensibly supported corneous antlers after the manner of the not too dissimilar pedicles of *Dicrocerus* and *Cervulus*. IX. *Aletomeryx* is represented by a very remarkable series of skulls, jaws and limb elements from the northern Nebraska type locality, in our own and in the Yale and Nebraska State Universities' collections. The speci-

mens are witness to a wide variation in the height of the horn-pedicles, the height, as studied in combination with the wear of the teeth, seeming to be dependent upon sex and age. (See Fig. 1A, reconstruction of head as in flesh.) Closely allied but larger forms are seen in an *Aletomerycine* horn-pedicle, female crania and other remains in the University of Nebraska, from apparent Lower Miocene beds of Box Butte, Dawes and Morrill Counties, Nebraska. X. *Sinclairiomeryx*, new genus, of the Sheep Creek beds, is remarkable for the elongate, extremely slender and anteriorly arched postorbital horn-pedicles, for the elongate nasals bearing *Dicerathere*-like bosses and for the deep maxillary pits. In life corneous appendages were doubtlessly borne on the paired nasal bosses as well as on the bulbous tips of the paired horn-pedicles. The genus is represented in a series of partial crania and a considerable collection of mandibular dentitions. The latter, though of larger size than in *Aletomeryx*, are characterized by *Aletomerycine*-like subhyp-sodont molars and reduced premolars. The elongate nasals and nasal bosses of *Sinclairiomeryx* are in contrast to the short nasals and stout maxillary horns of the *Protoceratidæ*. (Compare reconstructions of heads in the flesh, frontispiece, D, and Fig. 59.)

The craniometry of the forty-four named species (twenty-nine of which are new), fourteen genera and subgenera, of the six subfamilies of the two Cervid Divisions,

A.—DROMOMERYCINI

- 1.—Cranioceratinæ
- 2.—Dromomerycinæ
- 3.—Barbouromerycinæ
- 4.—Drepanomerycinæ, and

B.—ALETOMERYCINI

- 5.—Yumaceratinæ
- 6.—Aletomerycinæ,

is preliminarily discussed, commencing with page 75 and following the measurement tables and comparative illustrations of the examples of dentitions. The limb elements of the two divisions are considered in the next following section of the report.

TABLE II
DROMOMERYCINI AND ALETOMERYCINI MANDIBLES
COMPARATIVE MEASUREMENTS AND RATIOS
[Millimeters]

	Collection No.	Tooth Wear	$\frac{m_3}{PS\ d.}$	$\frac{P_1-P_4}{m_1-m_3}$	$\frac{P_2}{P_4}$	$\frac{P_2}{m_3}$	$\frac{P_3}{P_4}$	$\frac{P_3}{m_3}$	$\frac{P_4}{m_3}$	See Fig.
<i>Cranioceras unicornis</i> Matthew, ref., Sioux Co., Nebr....	A.M.17338	W+	$\frac{29.6}{49.} = 62\%$	$\frac{((39.))}{64.5} = ((60))\%$	$\frac{15.}{(8.5)}$		$\frac{13.4}{15.} = 89\%$		45%	
"	A.M.22384	W	$\frac{27.4}{53.} = 52$	$\frac{(35.8)}{59.2} = (60)$	$\frac{(8.5)}{13.9} = (61)\%$		$\frac{13.5}{13.9} = 97$		49	6
" ?ref.....	F.A.M.31204	M+	$\frac{24.4}{24.4}$	$\frac{31.5}{53.8} = 59$	$\frac{9.}{12.5} = 72$	37	$\frac{11.2}{12.5} = 90$		45	
<i>C. mefferdi</i> , n.sp., ref., Cherry Co., Nebr.....	F.A.M.32367	M	$\frac{25.}{43.} = 58$	$\frac{41.5}{60.} = 69$	$\frac{12.5}{16.} = 78$	50	$\frac{15.}{16.} = 94$		60	
" ?var., Dawes Co., Nebr....	F.B.A.M.32860	M+	$\frac{27.5}{27.5}$	$\frac{(42.)}{60.} = (70)$	$\frac{12.}{16.7} = 72$	44	$\frac{16.}{16.7} = 96$		58	4, 4A
<i>C. (P.) stinneri</i> , subgenotype, Brown Co., Nebr.....	F.A.M.31250	M+	$\frac{23.4}{46.} = 51$	$\frac{34.6}{56.} = 62$	$\frac{8.5}{14.} = 61$	36	$\frac{12.7}{14.} = 91$		54	11
" ref.....	F.A.M.31251	W+	$\frac{23.2}{45.} = 52$	$\frac{34.3}{53.8} = 64$	$\frac{9.5}{13.5} = 70$	41	$\frac{12.5}{13.5} = 92$		54	12
<i>C. dakotensis</i> , n.sp., type, Rosebud, S. Dak.....	A.M.10952	M	$\frac{24.5}{24.5}$	$\frac{37.8}{59.7} = 63$	$\frac{10.}{15.} = 67$	41	$\frac{13.5}{15.} = 90$		55	7
<i>C. teres</i> (Cope), ref., N. Mex....	F.A.M.31286	W	$\frac{38.}{38.}$	$\frac{((35.))}{((35.))}$	$\frac{14.}{14.}$		$\frac{13.5}{14.} = 96$			
"	F.A.M.31284	M	$\frac{23.}{23.}$	$\frac{54.5}{54.5}$	$\frac{14.}{14.}$		$\frac{(13.)}{14.} = (93)$		(57)	8

<i>C. grani</i> , n.sp., ref., W. Cherry Co., Nebr.....	F.A.M.32401	M	$\frac{24.}{44.} = 55$	$\frac{((40.))}{(59.)} = ((68))$	$\frac{14.2}{14.2}$		$\frac{13.}{14.2} = 91$	54
<i>C. clarendonensis</i> , n.sp., type, Clarendon, Tex.....	F.A.M.32454	M+	$\frac{23.}{40.} = 57$	$\frac{34.5}{56.} = 62$	$\frac{9.5}{13.5} = 70$	41	$\frac{13.}{13.5} = 96$	57
" ref.....	F.A.M.32455	M	$\frac{22.5}{35.} = 64$	$\frac{32.}{56.5} = 57$	$\frac{8.4}{13.} = 65$	37	$\frac{12.5}{13.} = 96$	56
"	F.A.M.32211	M	22.	$\frac{(33.)}{(54.)} = (61)$	$\frac{8.8}{(13.2)} = (67)$	40	$\frac{12.2}{(13.2)} = (92)$	55
<i>Dromomeryx whitfordi</i> Sinclair, ref., Sioux Co., Nebr.....	F.A.M.31504	W	$\frac{(27.5)}{52.} = (53)$	$\frac{41.5}{63.} = 66$	$\frac{12.5}{15.5} = 80$	(45)	$\frac{14.5}{15.5} = 93$	(53)
"	A.M.22386	M+	$\frac{29.2}{55.} = 53$	$\frac{43.7}{69.} = 63$	$\frac{12.6}{16.} = 79$	43	$\frac{15.5}{16.5} = 94$	53
"	A.M.18872A	M+	$\frac{27.5}{27.5}$	$\frac{42.}{60.5} = 69$	$\frac{12.6}{16.} = 79$	46	$\frac{14.8}{16.} = 93$	54
"	A.M.18873	W	$\frac{29.5}{50.} = 59$	$\frac{46.}{69.} = 67$	$\frac{13.3}{16.8} = 79$	45	$\frac{16.5}{16.8} = 98$	56
<i>D. paumiensis</i> , n.sp., ref., Pawnee Creek, Colo.....	F.A.M.31306	M	29.	$\frac{45.5}{67.5} = 67$	$\frac{12.7}{16.5} = 77$	44	$\frac{16.5}{16.5} = 100$	57
"	F.A.M.31299	M+	$\frac{65.}{65.}$	$\frac{40.5}{40.5}$	$\frac{12.}{15.} = 80$		$\frac{14.2}{14.3} = 99$	6
"	A.M.9450	W++	$\frac{29.}{54.} = 54$	$\frac{40.}{61.} = 66$	$\frac{11.7}{15.5} = 75$	40	$\frac{14.}{15.5} = 97$	48
<i>Rakomeryx raki</i> , n.sp. (or <i>R. joraltianus</i> , n.sp.), ref., Barstow, Calif.....	F.A.M.31782	M+	$\frac{28.8}{28.8}$	$\frac{(41.3)}{67.5} = (61)$	$\frac{10.3}{17.} = 61$	(36)	$\frac{15.}{17.} = 88$	52

(Continued on next page)

TABLE II—Continued

	Collection No.	Tooth Wear	$\frac{m_3}{PS\ d.}$	$\frac{Pr-P_4}{m_1-m_3}$	$\frac{P_2}{p_4}$	$\frac{P_2}{m_3}$	$\frac{P_3}{p_4}$	$\frac{P_3}{m_3}$	See Fig.
<i>Rakomeryx raki</i> , n.sp. (or <i>R. jorakianus</i> , n.sp.), ref., Barstow, Calif.....	F.A.M. 31353	M++	$\frac{26.}{47.}$ = 55	$\frac{36.5}{62.5}$ = 58	$\frac{9.5}{13.7}$ = 69	37	$\frac{13.}{13.7}$ = 95	50	
“	F.A.M. 31341	W	$\frac{26.6}{44.5}$ = 60	$\frac{36.7}{61.}$ = 60	$\frac{9.1}{14.}$ = 65	34	$\frac{13.8}{14.}$ = 98	52	6, 8
“	F.A.M. 31788	M	$\frac{24.}{27.5}$	$\frac{((35.))}{58.8}$ = ((60))	$\frac{13.5}{13.5}$		$\frac{13.5}{13.5}$ = 100	56	
<i>R. yermoneus</i> , n.sp., type, Mojave Desert, Calif.....	F.A.M. 31800	M+	$\frac{27.5}{((27.))}$	$\frac{((39.5))}{(65.)}$ = ((61))	$\frac{14.}{14.}$		$\frac{13.7}{14.}$ = 98	50	8
<i>Yumaceras falkenbachii</i> , n.sp., ref., Okla.....	F.A.M. 32104	M+	$\frac{26.3}{((27.))}$	$\frac{37.5}{((67.))}$ = ((56))	$\frac{9.1}{14.8}$ = 61	34	$\frac{13.5}{14.8}$ = 91	((50))	9
“	F.A.M. 31670	W	$\frac{26.3}{23.5}$	$\frac{38.}{(64.)}$ = (59)	$\frac{10.5}{15.2}$ = 69	40	$\frac{13.4}{15.2}$ = 88	50	
<i>Sindoiromeryx riparius</i> , var., ref., Sioux Co., Nebr.....	F.A.M. 31223	M+	$\frac{23.5}{33.5}$ = 70	$\frac{25.5}{52.5}$ = 49	$\frac{7.1}{10.4}$ = 68	30	$\frac{8.7}{10.4}$ = 84	37	
<i>S. riparius</i> (Matthew), ref., Sioux Co., Nebr.....	A.M. 18958	M	$\frac{21.7}{28.5}$ = 76	$\frac{25.1}{50.}$ = 50	$\frac{6.4}{10.}$ = 64	29	$\frac{9.4}{10.}$ = 94	43	5, 7
<i>Bourromeryx paumiensis</i> , n.sp., type, Pawnee Creek, Colo...	F.A.M. 31290	W	$\frac{21.7}{21.}$	$\frac{((33.))}{47.5}$ = ((69))	$\frac{12.}{12.}$		$\frac{12.}{12.}$ = 100	55	7
(?) <i>B. americanus</i> (Douglass), type, Mont.....	C.M. 705	M+	$\frac{21.}{47.2}$	$\frac{(31.)}{(47.2)}$ = (66)	$\frac{9.}{(11.4)}$ = (79)	43	$\frac{((11.5))}{((11.4))}$ = (101)	((55))	

<i>B. milleri</i> , subgenotype, Sioux Co., Nebr.....	A.M.21533	M+	$\frac{21.}{34.5}$	= 61	$\frac{32.}{49.}$	= 65	$\frac{9.}{12.5}$ = 72	43	$\frac{12.}{12.5}$ = 96	57	5, 7
<i>Subdromeryx scotti</i> , ?ref., Sioux County, Nebr.....	F.A.M.31212	M	$\frac{20.}{24.}$	= 83	$\frac{(31.)}{46.5}$ = (67)	$\frac{8.5}{12.3}$ = 69	$\frac{43}{43}$	$\frac{11.}{12.3}$ = 89	55	5, 7	
"	F.A.M.32487	M+	$\frac{21.}{25.}$	= 84	$\frac{33.}{49.}$ = 67	$\frac{9.3}{12.5}$ = 74	$\frac{44}{44}$	$\frac{12.}{12.5}$ = 96	57	4, 4A	
<i>Barbouromeryx trigonocorneus</i> (B. & S.), genotype, Dawes Co., Nebr.....	N.S.M.3-27-11-33	M	$\frac{17.}{23.}$	= 74	$\frac{28.}{40.}$ = 70	$\frac{7.7}{10.5}$ = 73	$\frac{45}{45}$	$\frac{9.5}{10.5}$ = 90	56	5, 7, 1A	
<i>Probarbouromeryx sweeti</i> , n. subg. and sp., ref., Morrill Co., Nebr.....	N.S.M.57-6-7-34	M+	$\frac{20.}{16.5}$	= 72	$\frac{27.}{38.5}$ = 64	$\frac{8.}{9.6}$ = 80	$\frac{42}{42}$	$\frac{8.5}{9.6}$ = 89	52	4	
"	N.S.M.21-25-6-35	M+	$\frac{16.5}{23.}$	= 72	$\frac{24.5}{38.5}$ = 64	$\frac{7.}{9.6}$ = 73	$\frac{42}{42}$	$\frac{8.5}{9.6}$ = 89	52	4	
<i>Probarbouromeryx marslandensis</i> , subgenotype, Morrill Co., Nebr.....	N.S.M.3-24-7-34	W	$\frac{16.5}{23.}$	= 72	$\frac{24.5}{38.5}$ = 64	$\frac{7.}{9.6}$ = 73	$\frac{42}{42}$	$\frac{8.5}{9.6}$ = 89	52	4	
[<i>Sindairomeryx</i> —see above.]											
<i>Aletomeryx lugni</i> , n.sp., type, Morrill Co., Nebr.....	N.S.M.13-1-7-32	W	$\frac{18.}{27.}$	= 66	$\frac{37.}{37.}$ = ((61))	$\frac{4.8}{8.5}$ = 56	$\frac{27}{27}$	$\frac{7.}{8.5}$ = 82	39		4, 4A
<i>A. marslandensis</i> , n.sp., ref., Box Butte Co., Nebr.....	N.S.M.11-24-8-34	W	$\frac{18.}{27.}$	= 66	$\frac{40.}{40.}$ = 52	$\frac{5.}{8.5}$ = 59	$\frac{36}{36}$	$\frac{7.4}{8.5}$ = 88	46		
<i>A. gracilis</i> (Lull), ref., Cherry Co., Nebr.....	F.A.M.32330	M	$\frac{16.}{23.}$	= 70	$\frac{22.}{39.}$ = 56	$\frac{5.1}{8.5}$ = 57	$\frac{34}{34}$	$\frac{7.2}{9.}$ = 80	48		16
"	F.A.M.32334	-M	$\frac{15.}{23.}$	= 65	$\frac{21.5}{37.5}$ = 57	$\frac{5.1}{9.}$ = 57	$\frac{34}{34}$	$\frac{7.2}{9.}$ = 80	48		16

() approximate; (()) estimated.

KEY TO ILLUSTRATIONS OF DROMERYCINI-ALETOMERYCINI

LOWER DENTITIONS			UPPER DENTITIONS		CRANIA OR HORNS	LMBS
OCCUSAL VIEWS	LATERAL VIEWS	OCCUSAL VIEWS				
Figure 4A (in part)		Figure 4A (in part)		Figure		Figure
N.S.M.3-24-7-34, <i>Probarbouromeryx marslandensis</i> , sct.	x	N.S.M.21-25-6-35, <i>Probarbouromeryx suetzi</i> , R.		[14]sgt, R.	[25A]R	
N.S.M.97-25-6-35, <i>Probarbouromeryx suetzi</i> , x.	x			[14]sgt, R.	[25A]R	
N.S.M.13-1-7-32, <i>Aletomeryx tugui</i> , T.	x			[16]T, [16A]R.	[25B] var.	
N.S.M.6-18-7-34, A. <i>marslandensis</i> , R.	x					
F.B.A.M.32878, <i>Sinclairomeryx tedi</i> , R.	x			[18A]R		
F.F.A.M.32487, <i>Subdromomeryx scotti</i> , ?R.	x			[18A]R		
F.F.A.M.32485, <i>Cranioeceras clarendonensis</i> , R.	x			[18A]T		
F.F.A.M.32454, " "	x					
F.B.A.M.32860, C. <i>mefferdi</i> , var.	x			[8]R, [14]T, R.	[17]R	
F.F.A.M.31509, <i>Dromomeryx whitfordi</i> , B (for molars, see Fig. 9).	x					
Figure 7		Figure 5		Figure 10		
F.F.A.M.32326, <i>Aldomeryx gracilis</i> , R.		F.A.M.32290, R.		[16]R.	[25A]R, [25B]R	
N.S.M.3-27-11-33, <i>Barbouromeryx trigono-</i>		F.A.M.32286, R.		[16]R.	[25A]R, [25B]R	
<i>corneus</i> , gt.	x			sgt, 14gt	25gt	
F.F.A.M.31216, <i>Sinclairomeryx riparius</i> var., R.	x (act. 6th spec.)			[16B]R		
A.M.18958B, " "						
A.M.18958, (?) <i>S. riparius</i> , R.		F.A.M.31247, (?) <i>S. riparius</i> , R				
		F.A.M.31386, <i>S. sinclairi</i> , R.				
	x					
F.F.A.M.31212, <i>Subdromomeryx scotti</i> , ?R.	x	A.M.18956, T				
A.M.21533, <i>Bouroumeryx milleri</i> , sct.	x					
F.A.M.31290, B. <i>pauvrensis</i> , T		P.U.10401, <i>Subdromomeryx antilopinus</i> , T.		[16A]sgt, R, [16B] R		18T
A.M.10952, <i>Cranioeceras dalcensis</i> , T.						
F.A.M.31253, C. (P.) <i>skinneri</i> , R.	x (see also Fig. 12)	A.M.10953, R		14At		
		F.A.M.31250, sct (in part) (see also Fig. 12)				
		F.A.M.31211, (?) <i>Drepanomeryx</i> species, (?)R.		sgt, 14gt, [12]R, [12A]R		[18]R
		A.M.15584, <i>Palaemeryx kaupii</i> , R, Europe (see Fig. 8)		[12A]R, [16] ?R		[18A]R, [16] ?R

Figure 8		Figure 6	
F.A.M. 31280, <i>Cranioceras tersa</i> , R.			[12]r
F.A.M. 31284, " "			[12]r
F.A.M. 31800, <i>Rakomeruz yermolenstis</i> , T		F.A.M. 31286, R.	
F.A.M. 31200, <i>Cranioceras unicornis</i> , R.		A.M. 22384, R.	[12]gr..... [17]R, [18]R
F.A.M. 31325, <i>Rakomeruz raki</i> (or <i>Joraki-anus</i>), R.		Figure 10A	
F.A.M. 31341, <i>Rakomeruz raki</i> (or <i>Joraki-anus</i>), R.		F.A.M. 31788A, <i>Rakomeruz raki</i> (or <i>Jorakianus</i>), R.	[15]gr, T..... [18]R
A.M. 15584, <i>Palsomeruz kaupti</i> , R. Europe..			[15]gr, T..... 18R
Figure 9			[18]R
F.A.M. 31228, <i>Dromomeruz whitfordi</i> , R.			
F.A.M. 31509, " " (for premolars, see Fig. 4A)			
F.A.M. 31306, <i>D. pavniensis</i> , R.		F.A.M. 31245, R.	[2, 2A]R, [14]T, R, [14B]R [17]R
F.A.M. 31782, <i>Rakomeruz raki</i> (or <i>Joraki-anus</i>), R.			
F.A.M. 31522, <i>Yumaceras falkenbachii</i> , var.		A.M. 22386, <i>Dromomeruz whitfordi</i> , R (act. 8th spec.)	[2, 2A]R, [14]T, R, [14B]R [17]R
F.A.M. 32134, <i>Y. falkenbachii</i> , R.		F.A.M. 31289, <i>D. pavniensis</i> , R.	[14]T
F.A.M. 31673, " "			[14]T
F.A.M. 32104, " "			14A R, [14]gr, R..... [17]R
Col. M. 200, <i>Y. fagpinsi</i> , ?R.		F.A.M. 31780, R.	[15]gr, T..... [18]R
		F.A.M. 31674, R	
		F.A.M. 31676, R (m ^s only)	
			[12A]gr..... [17]R

x = lateral view of identical mandibular dentition (2d column), or occlusal view of associated maxillary dentition (3d column).

T = type, or = genotype, ser = subgenotype, R = referred.

Figures of crania, horns or limbs, as indicated in the last two columns: unbracketed = identical or associated specimen; bracketed = same species but different specimen. Species not cited in the table: *Cranioceras grani*, T (F.A.M. 32064) and R (F.A.M. 32065, 32066) Fig. 12; R (F.A.M. 31270), Fig. 12A; R (F.A.M. 31262), Fig. 12A; C. *pavniensis*, T (F.A.M. 31294), Fig. 12A; *Subdromomeruz scotti*, ser (F.A.M. 33767, 33769, 32835), Fig. 14B; S. *Wilsoni*, T (F.A.M. 33800), Fig. 14B; *Rakomeruz pseudoneobracensis*, R (F.B.A.M. 34050, 34024), Fig. 14B; *Drepanomeruz falciformis*, gr (F.U. 12072), Fig. 16; *Mathomeruz matthewi*, ser (F.B.A.M. 33740) and R (F.B.A.M. 33739, 33741, 33742), Fig. 16; *Aldomeruz scotti*, T (M.C.Z. 17743), Fig. 16A; *A. marsali*, R (A.M. 14264), Fig. 26A.

SUMMARY OF DROMOMERYCINI AND ALETOMERYCINI SPECIMENS

Genus No.	LATE TERTIARY	Crania	Horns	Maxilla	Mandibles	Limbs	Total Elements	Assoc. Elements	Total Specimens
	DIVISION A.—DROMOMERYCINI								
I	<i>Cranioceras</i> Matthew and								
IA	<i>Procranioceras</i> , n.subg....	6	21[4]	70[5]	155[2]	82[1]	334	12	322
II	<i>Rakomeryx</i> , n.g.....	1	5	23[4]	36[1]	10[2]	75	7	68
III	<i>Dromomeryx</i> Douglass.....	6	12[4]	43[5]	77[1]	30[2]	168	12	156
IIIA	<i>Subdromomeryx</i> , n.subg.....	4	5[4]	8[4]	41	27[1]	85	9	76
IV	<i>Bouromeryx</i> , n.subg.....		2	10	48	6	66		66
VI	<i>Drepanomeryx</i> Sinclair.....	2	2	3[2]			7	2	5
VII	<i>Matthomeryx</i> , n.subg.....	1	3[1]	3	11		18	1	17
	DIVISION B.—ALETOMERYCINI								
VIII	<i>Yumaceras</i> , n.g.....		1	23	20	6	50		50
X	<i>Sinclairiomeryx</i> , n.g.....	4	10[4]	11[3]	68	40	133	7	126
		<u>24</u>	<u>61</u>	<u>194</u>	<u>456</u>	<u>201</u>	<u>936</u>	<u>50</u>	<u>886</u>
	MIDDLE TERTIARY								
	DIVISION A.—DROMOMERYCINI								
V	<i>Barbouromaryx</i> , n.g.....	1	[1]	3[1]	9[1]	[1]	15	4	11
VA	<i>Probarbouromaryx</i> , n.subg....	1	2[1]	18	30	27	78	1	77
VB	<i>Protobarbouromaryx</i> , n.subg..				2		2		2
	DIVISION B.—ALETOMERYCINI								
IX	<i>Aletomeryx</i> Lull.....	46	17[15]	56[42]	56[6]	86[3]	*321	66	*255
		<u>48</u>	<u>20</u>	<u>77</u>	<u>97</u>	<u>114</u>	<u>416</u>	<u>71</u>	<u>345</u>
	Total Late Tertiary						1552	121	1231
	Grand Totals						1552	121	1231

*Including 60 miscellaneous.

[] Associated specimens.

FIG. 3. Size range in American Middle and Late Tertiary Cervids, as seen in lateral views of mandibular milk dentitions.

× 1. 1, anterior cingulum; 2, posterior cingulum; 3, "Palæomeryx" fold; 4, intercolumnar or accessory tubercle of m₁; p₁ considered identical with dp₁.

F:A.M.31354, (?) *Pseudoblastomeryx marsa*, n.sp., type, rev., Cherry Co., Nebr.
(See page 260.)

A.M.22388B, *Blastomeryx gemmifer medius* (Matthew), var., ref., Sioux Co., Nebr.
(See page 240.)

F:A.M.32291A, *Aletomeryx gracilis* Lull, ref., Cherry Co., Nebr.
(See page 159.)

A.M.18959, (?) *Sinclairiomeryx riparius* (Matthew), ref., rev., Sioux Co., Nebr.
(See page 166.)

F:A.M.32491, *Subdromomeryx scotti*, n.subg. and sp., tent. ref., Sioux Co., Nebr.
(See page 125.)

F:A.M.31199, *Bouromeryx nebrascensis*, n.sp., ref., Sioux Co., Nebr.
(See page 131.)

F:A.M.32216A, *Cranioceras clarendonensis*, n.sp., ref., rev., Clarendon, Tex.
(See page 96.)

F:A.M.32375, *Cranioceras mefferdi*, n.sp., ref., Cherry Co., Nebr.
Cranioceras, versus *Dromomeryx*, /dps larger relative to m₁ and p₁ absent. (See page 89.)

F:A.M.31804, *Rakomeryx yermontensis*, n.sp., ref., Mojave Desert, Calif.
(See page 106.)

F:A.M.32146, *Yumaceras falckenbachii*, n.sp., ref., Texas Co., Okla.
(See page 145.)

A.M.18875 & F:A.M.31508, *Dromomeryx whitfordi* Sinclair, ref., Sioux Co., Nebr.
(See pages 121, 118.)

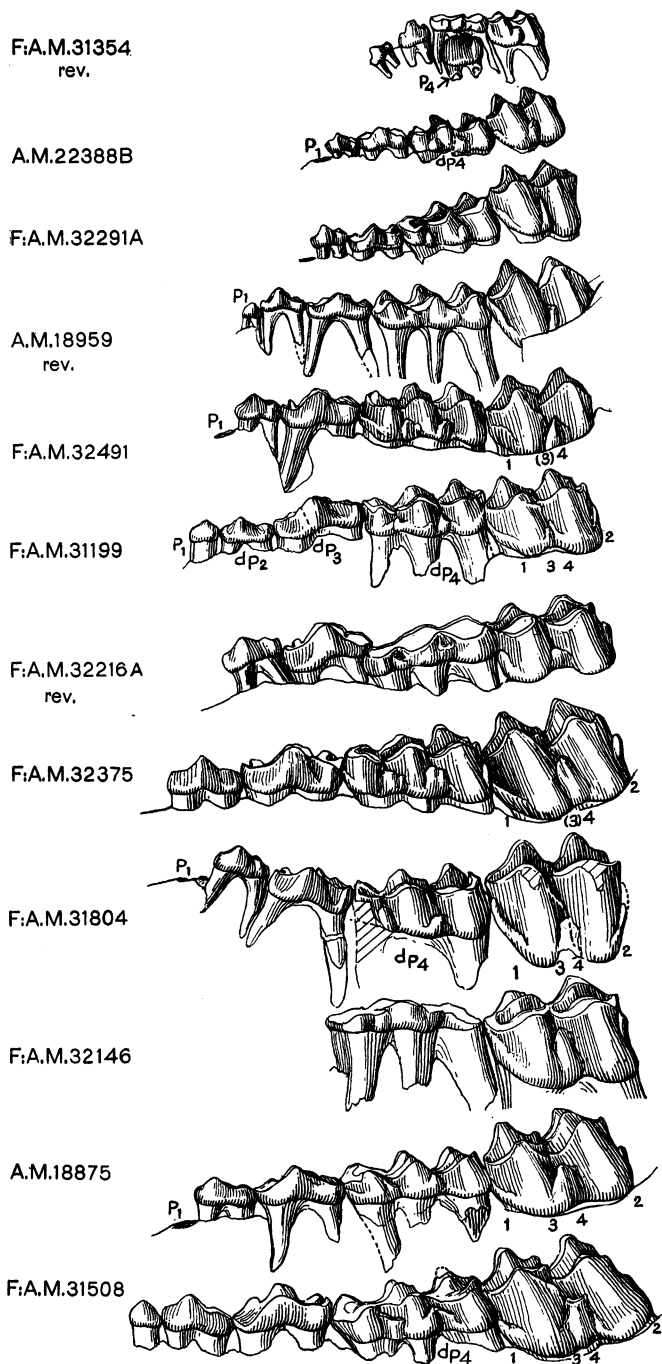


FIG. 3. Size range in American Middle and Late Tertiary Cervids, as seen in mandibular milk dentitions—Blastomerycini, Aletomerycini and Dromomerycini, lateral views.

× 1. (See legend, page 58.)

N.S.M. 23-12-7-34
rev.

N.S.M. 3-24-7-34

N.S.M. 21-25-6-35

N.S.M. 97-25-6-35

N.S.M. 13-1-7-32
rev.

N.S.M. 5-18-7-34

F.B.A.M. 32878

F.A.M. 32487
rev.

F.A.M. 32455
rev.

F.A.M. 32454
rev.

F.B.A.M. 32860
rev.

F.A.M. 31509

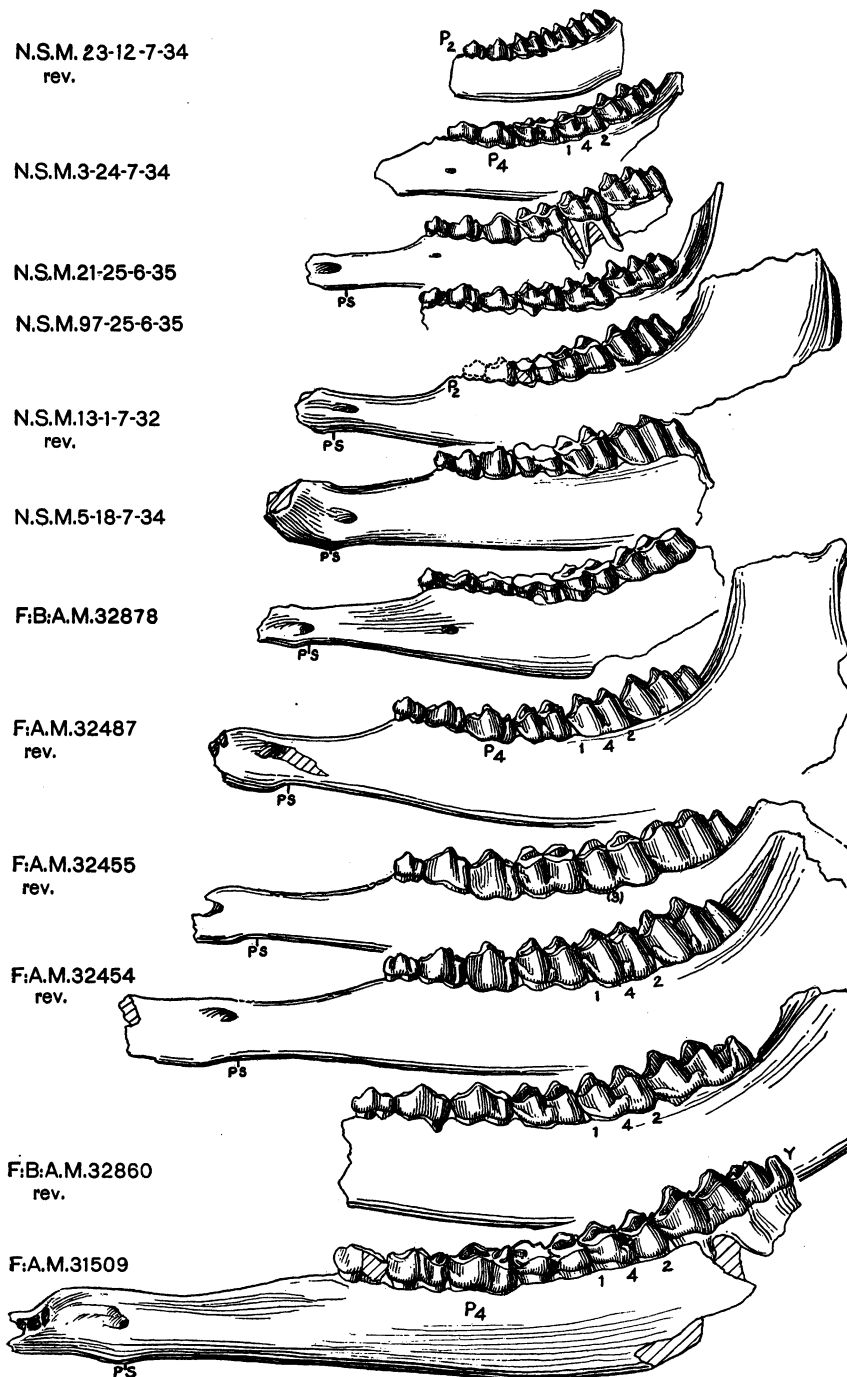


FIG. 4. Size range in Cervids of the American Middle and Late Tertiary. *Blastomeryx* Cope, *Protobarbouromeryx*, n.subg., *Probarbouromeryx*, n.subg., *Aletomeryx* Lull, *Sinclairomeryx*, n.g., *Subdromomeryx*, n.subg., *Cranioceras* Matthew and *Dromomeryx* Douglass, lateral views of mandibular dentitions.

× $\frac{1}{2}$. (See occlusal views, Fig. 4A, opposite [excepting N.S.M. 21-25-6-35] and legend, page 67).

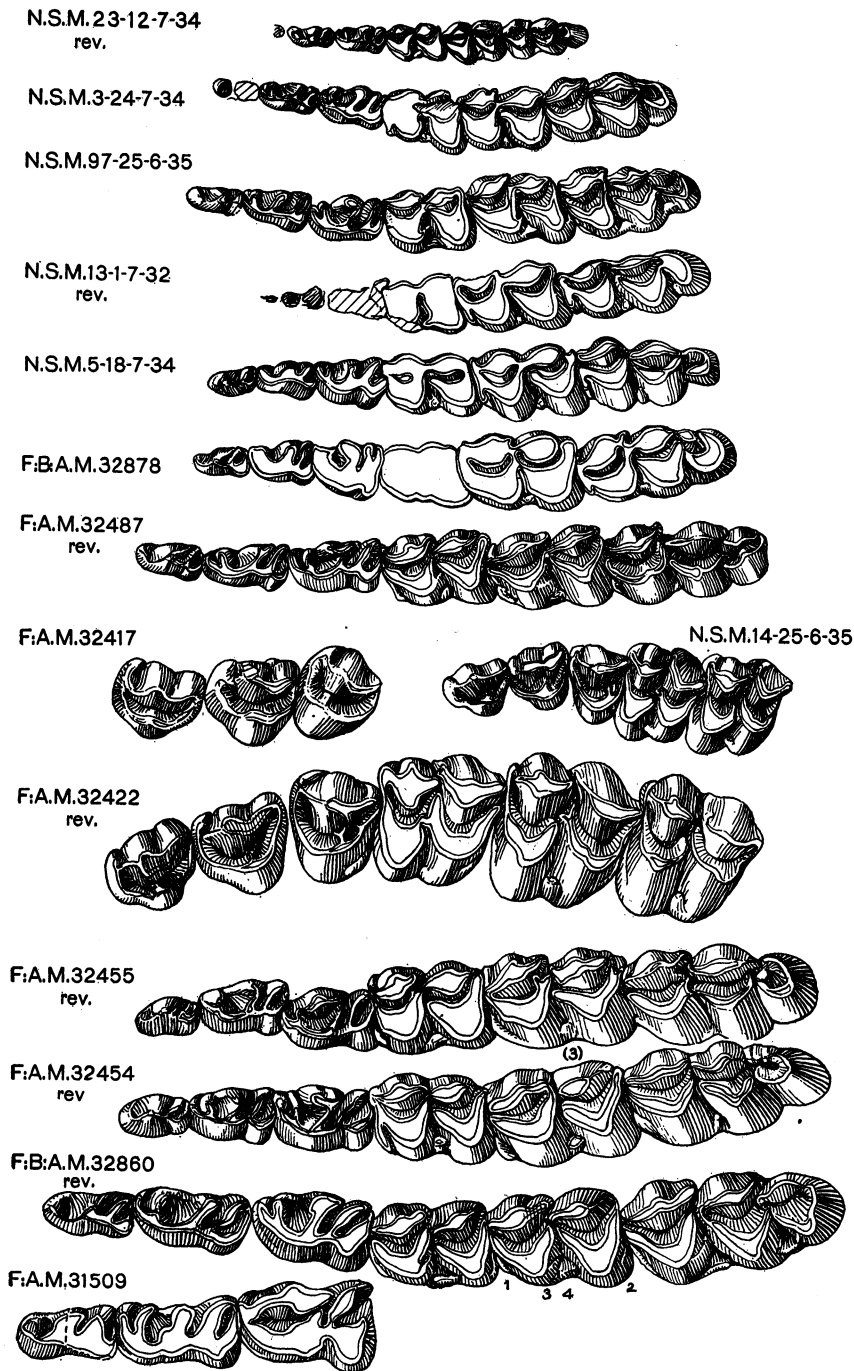


Fig. 4A. Size range in Cervids of the American Middle and Late Tertiary. *Blastomeryx* Cope, *Protobarbouromeryx*, n.subg., *Probarbouromeryx*, n.subg., *Aletomeryx* Lull, *Sinclairomeryx*, n.g., *Subdromomeryx*, n.subg., *Cranioceras* Matthew and *Dromomeryx* Douglass, occlusal views of mandibular and maxillary dentitions.

× 1. (See lateral views, Fig. 4, opposite [excepting N.S.M.14-25-6-35, F.A.M.32417 and 32422] and legend, page 67.)

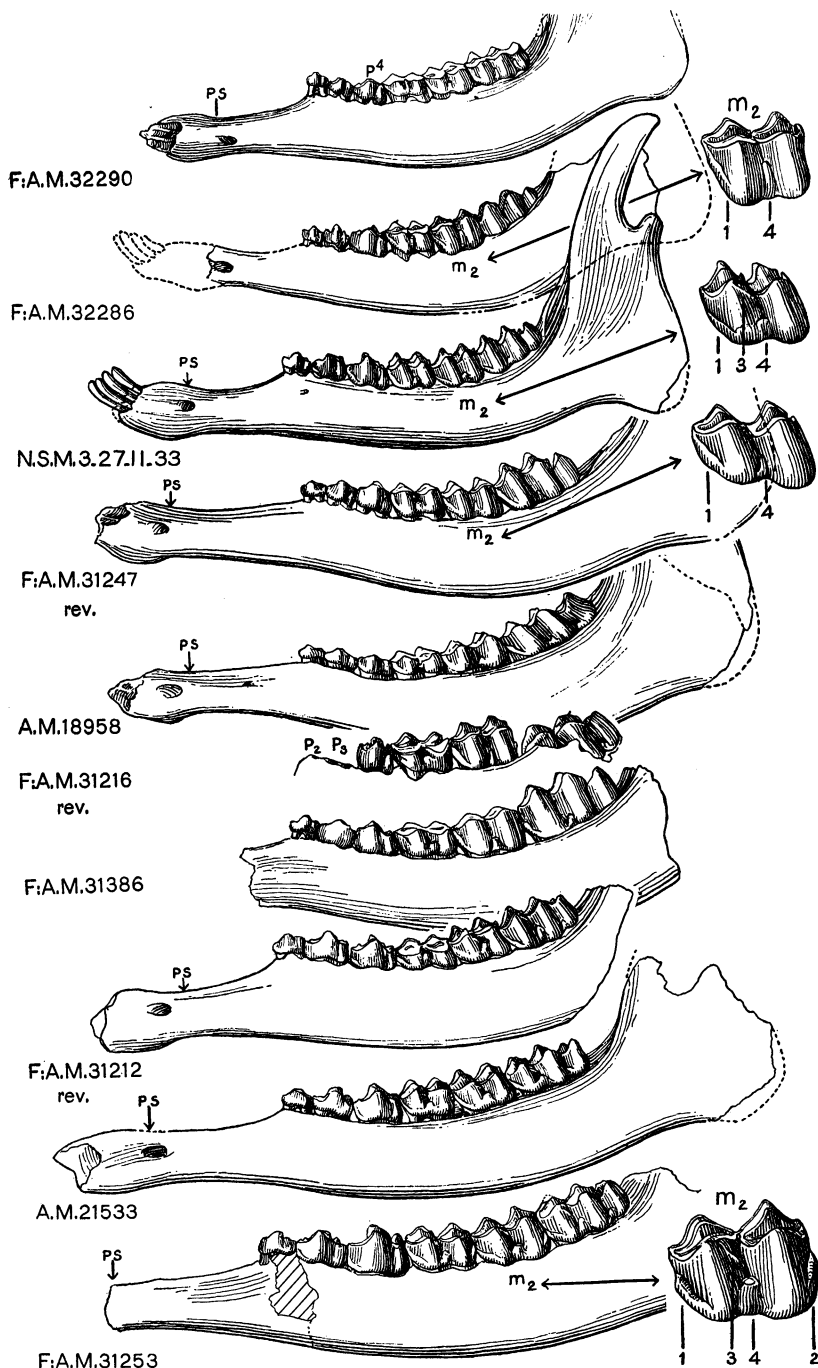


FIG. 5. *Aletomeryx* Lull, *Barbouromeryx*, n.g., (?)*Sinclairiomeryx*, n.g., (?)*Subdromomeryx*, n.subg., *Bouromeryx*, n.subg., and *Procranioceras*, n.subg., mandibular dentitions, lateral views compared.

$\times \frac{1}{2}$ (m₂ $\times 1$). (See legend, page 68.)

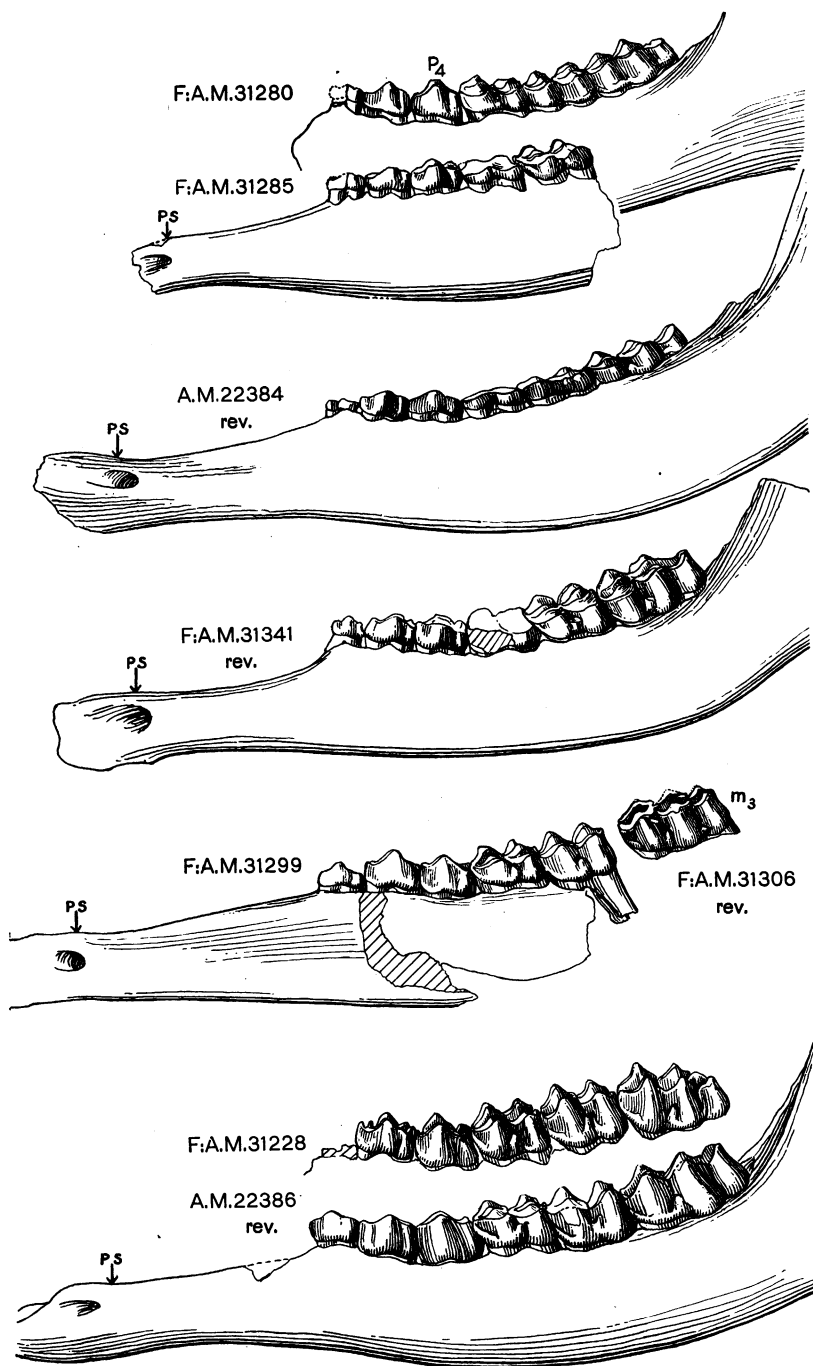


FIG. 6. *Cranioceras* Matthew, *Rakomeryx* n.g., and *Dromomeryx* Douglass, mandibular dentitions, lateral views compared.

× $\frac{1}{2}$. (See legend, page 68.)

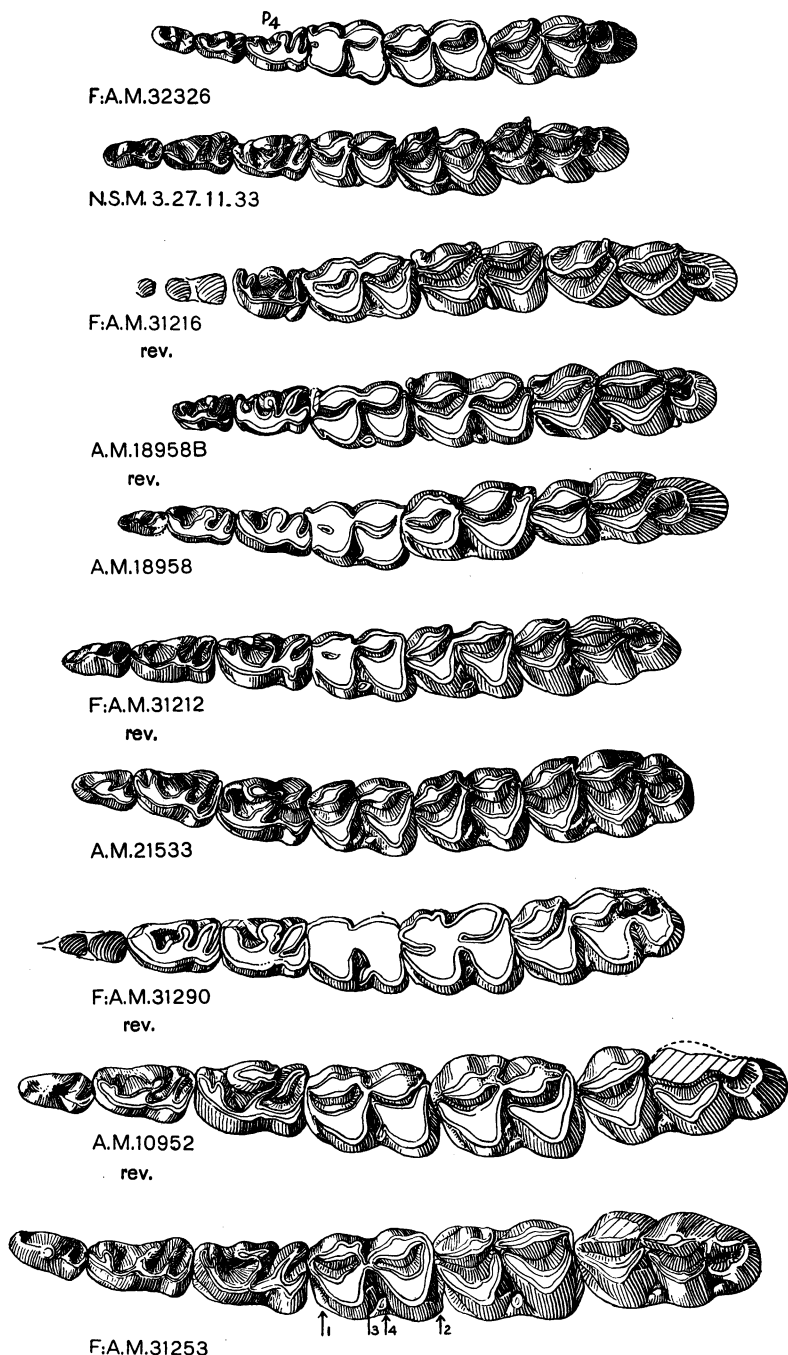


FIG. 7. *Aletomeryx* Lull, *Barbouromeryx*, n.g., (?)*Sinclairomeryx*, n.g., (?)*Subdromomeryx*, n.subg., *Bouromeryx*, n.subg., *Cranioceras* Matthew and *Procranioceras*, n.subg., mandibular dentitions, occlusal views compared.
X 1. (See legend, page 69.)



F.A.M.31280



F.A.M.31284

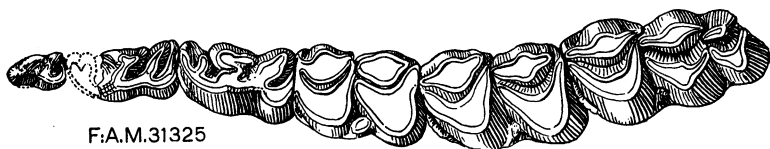
rev.



F.A.M.31800



F.A.M.31200



F.A.M.31325



F.A.M.31341

rev.



A.M.15584

FIG. 8. *Cranioceras* Matthew, *Rakomeryx*, n.g., and *Palæomeryx* Meyer (Europe), mandibular dentitions, occlusal views compared.

× 1. (See legend, page 69.)

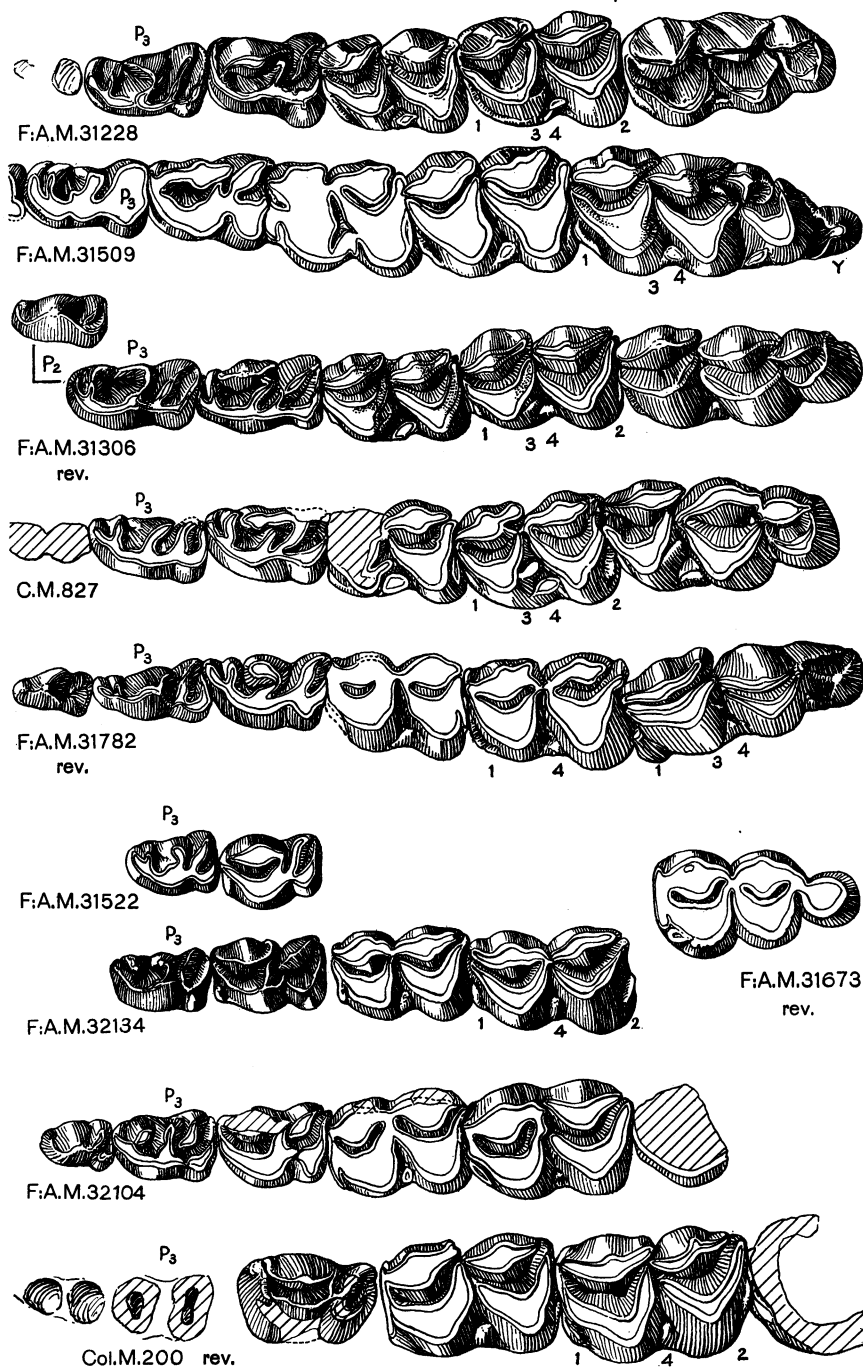


FIG. 9. *Dromomeryx* Douglass, *Rakomeryx*, n.g., and *Yumaceras*, n.g., mandibular dentitions, occlusal views compared.

× 1. (See legend, page 72.)

FIGS. 4 AND 4A. Size range in Cervids of the American Middle and Late Tertiary. Dromomerycini and Aletomerycini (and *Blastomeryx*) mandibular and maxillary dentitions.

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. PS, posterior border symphysis; 1, anterior cingulum; 2, posterior cingulum; 3, "Palaeomeryx" fold; and 4, intercolumnar or accessory tubercle.

Fig. 4. N.S.M.23-12-7-34, *Blastomeryx gemmifer medius* (Matthew), var., ref., rev., from Dawes County, Nebraska.

(See page 241.)

N.S.M.3-24-7-34, *Protobarbouromeryx marslandensis*, n.subg. and sp., subgenotype, from Box Butte County, Nebraska.

(See page 136.)

N.S.M.21- and 97-25-6-35, *Probarbouromeryx sweeti*, n.subg. and sp., ref., from Morrill County, Nebraska.

(See page 135.)

N.S.M.13-1-7-32, *Aletomeryx lugni*, n.sp., type, rev., from Morrill County, Nebraska. (Premolars from 14-1-7-32.)

(See page 161.)

N.S.M.5-18-7-34, *Aletomeryx marslandensis*, n.sp., ref., from Box Butte County, Nebraska. (p₂, slightly enlarged, from another specimen of the same number.)

(See page 163.)

F:B:A.M.32878, *Sinclairiomeryx tedi*, n.sp., ref., from Dawes County, Nebraska.

(See page 168.)

F:A.M.32487, *Subdromomeryx scotti*, ?ref., rev., from Sioux County, Nebraska.

(See page 124.)

F:A.M.32455 and 32454, *Cranioceras clarendonensis*, n.sp., ref. and type, rev., from Clarendon, Texas.

(See pages 95, 94.)

F:B:A.M.32860, *Cranioceras mefferdi*, (?)var., rev., from Dawes County, Nebraska.

(See page 90.)

F:A.M.31509, *Dromomeryx whitfordi* Sinclair, ref., from Sioux County, Nebraska. (Y = additional talonid cusp.)

(See also Fig. 9 and page 118.)

FIG. 4A. Occlusal views of mandibular specimens of Fig. 4 (excepting N.S.M. 21-25-6-35) and three additional maxillary specimens:

F:A.M.32417 and 32422, rev., *Cranioceras clarendonensis*, n.sp., ref., from Clarendon, Texas.

(See page 96.)

N.S.M.14-25-6-35, *Probarbouromeryx sweeti*, n.subg. and sp., ref., from Morrill County, Nebraska.

(See page 135.)

FIGS. 5 AND 6. Mandibular dentitions, lateral views compared.

$\times \frac{1}{2}$ (ms $\times 1$). PS, posterior border symphysis; 1, anterior cingulum; 2, posterior cingulum; 3, "Palaeomeryx" fold; and 4, intercolumnar or accessory tubercle of ms.

FIG. 5. F:A.M.32290 and 32286, *Aletomeryx gracilis* Lull, ref., from Antelope Creek, Cherry County, Nebraska.

(See pages 159, 158.)

N.S.M.3-27-11-33, *Barbouromeryx trigonocorneus* (Barbour and Schultz), genotype, from Dawes County, Nebraska.

(See also Figs. 7, 10 [dentition], 2, 14 [skull], 25 [limbs] and page 134.)

F:A.M.31247 (rev.), A.M.18958 and F:A.M.31216 (var., rev.), (?) *Sinclairiomeryx riparius* (Matthew), ref., from Sioux County, Nebraska.

(See also Fig. 7 [A.M.18958 and F:A.M.31216] and pages 166, 165.)

F:A.M.31386, *Sinclairiomeryx sinclairi*, n.g. and sp., ref., from Sioux County, Nebraska.

(See page 164.)

F:A.M.31212, *Subdromomeryx scotti*, ?ref., rev., from Sioux County, Nebraska.

(See also Fig. 7 and page 124.)

A.M.21533, *Bouromeryx milleri*, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(See also Fig. 7 and page 130.)

F:A.M.31253, *Cranioceras (Procranioceras) skinneri*, n.subg. and sp., ref., from Devil's Gulch, Brown County, Nebraska.

(See also Figs. 7, 12 and page 87.)

FIG. 6. F:A.M.31280 and 31285, *Cranioceras teres* (Cope), ref., from Santa Cruz, New Mexico.

(See also Fig. 8 [F:A.M.31280] and page 93.)

A.M.22384, *Cranioceras unicornis* Matthew, ref., rev., from Sioux County, Nebraska.

(See page 83.)

F:A.M.31341, *Rakomeryx raki* (or *jarakianus*), n.sp., ref., rev., from Green Hills, Barstow, California.

(See also Fig. 8 and page 102.)

F:A.M.31299 and 31306 (ms, rev.), *Dromomeryx pawniensis*, n.sp., ref., from Pawnee Creek, Colorado.

(See also Fig. 9 [F:A.M.31306] and page 116.)

F:A.M.31228 and A.M.22386 (rev.), *Dromomeryx whitfordi* Sinclair, ref., from Sioux County, Nebraska.

(See also Fig. 9 [F:A.M.31228] and page 119.)

FIGS. 7, 8 AND 9. Mandibular dentitions, occlusal views compared.

× 1. 1, anterior cingulum; 2, posterior cingulum; 3, "Palæomeryx" fold; 4, intercolumnar or accessory tubercle.

FIG. 7. F:A.M.32326, *Aletomeryx gracilis* Lull, ref., from Antelope Creek, Cherry County, Nebraska.

(See page 158.)

N.S.M.3-27-11-33, *Barbouromeryx trigonocorneus* (Barbour and Schultz), genotype, from Dawes County, Nebraska.

(See also Figs. 5, 10 [dentition], 2, 14 [skull], 25 [limbs] and page 134.)

F:A.M.31216 (var., rev.), A.M.18958B (var., rev.) and 18958, (?) *Sinclairomeryx riparius* (Matthew), ref., from Sioux County, Nebraska.

(See also Fig. 5 [F:A.M.31216 and A.M.18958] and pages 166, 167, 165.)

F:A.M.31212, *Subdromomeryx scotti*, ?ref., rev., from Sioux County, Nebraska.

(See also Fig. 5 and page 124.)

A.M.21533, *Bouromeryx milleri*, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(See also Fig. 5 and page 130.)

F:A.M.31290, *Bouromeryx pawniensis*, n.sp., type, rev., from Pawnee Creek, Colorado.

(See page 133.)

A.M.10952, *Cranioceras dakotensis*, n.sp., type, rev., from Rosebud Agency, South Dakota (Lower Miocene).

(See page 91.)

F:A.M.31253, *Cranioceras (Procranioceras) skinneri*, n.subg. and sp., ref., from Devil's Gulch, Brown County, Nebraska.

(See also Figs. 5, 12 and page 87.)

FIG. 8. F:A.M.31280 and 31284 (rev.), *Cranioceras teres* (Cope), ref., from Santa Cruz, New Mexico. (Note detached condition of inner tubercle, F:A.M.31284, p4.)

(See also Fig. 6 [F:A.M.31280] and pages 93, 92.)

F:A.M.31800, *Rakomeryx yermomensis*, n.sp., type (p₂ and m₂ rev.), from east of Yermo, Mojave Desert, California.

(See page 105.)

F:A.M.31200, *Cranioceras unicornis* Matthew, ref., from Sioux County, Nebraska.

(See page 83.)

F:A.M.31325 and 31341 (rev.), *Rakomeryx raki* (or *zorakianus*), n.sp., ref., from Green Hills, Barstow, California. (F:A.M.31325, p₂ and p₃ reversed from opposite side.)

(See also Figs. 10A, 18 [F:A.M.31325, maxilla, limbs], 6 [F:A.M.31341] and pages 104, 102.)

A.M.15584, *Palæomeryx kaupi* Meyer, ref., from Orleans, France.

(Compare upper molar, A.M.15584 [different individual], Fig. 10.)

Fig. 9. (See legend, page 72.)

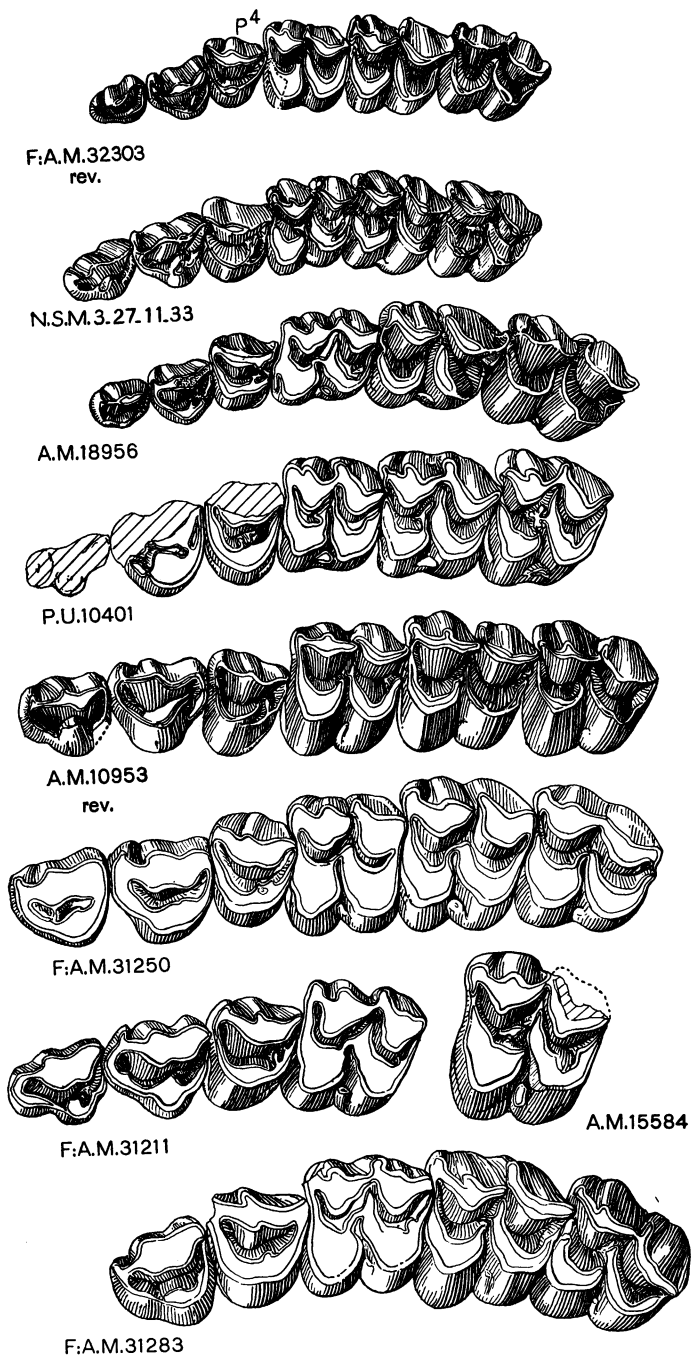
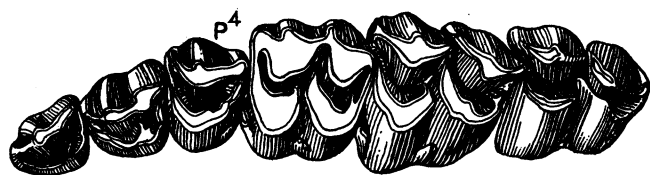
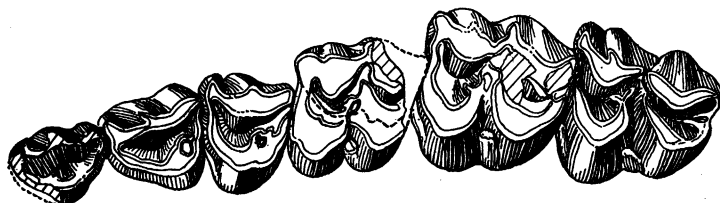


FIG. 10. *Aletomeryx* Lull, *Barbouromeryx*, n.g., (?)*Sinclairiomeryx*, n.g., *Subdromomeryx*, n.subg., *Cranioceras* Matthew, *Procranioceras*, n.subg., (?)*Drepanomeryx* Sinclair and *Palæomeryx* Meyer (Europe), maxillary dentitions, occlusal views compared.

× 1. (See legend, page 72.)



F.A.M.31788 A
rev.



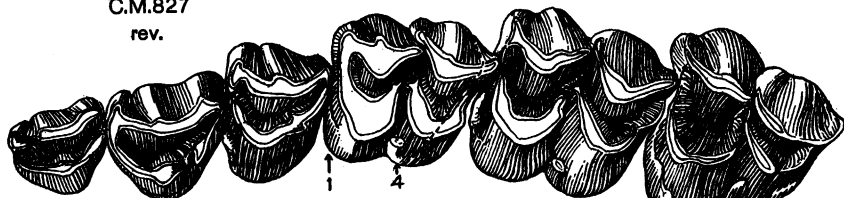
F.A.M.31325



F.A.M.31245
rev.



C.M.827
rev.



F.A.M.31780



F.A.M.31674

F.A.M.31676

FIG. 10A. *Rakomeryx*, n.g., *Dromomeryx* Douglass and *Yumaceras*, n.g., maxillary dentitions, occlusal views compared.

× 1. (See legend, page 73.)

FIG. 9. F:A.M.31228 and 31509, *Dromomeryx whitfordi* Sinclair, ref., from Sioux County, Nebraska. (Y, F:A.M.31509 = additional talonid cusp.)

(See also Figs. 4, 4A [F:A.M.31509], 6 [F:A.M.31228] and pages 119, 118.)

F:A.M.31306, *Dromomeryx pawniensis*, n.sp., ref., rev., from Pawnee Creek, Colorado.

(See also Fig. 6 [ms only] and page 116.)

C.M.827, *Dromomeryx borealis* (Cope), ref., from Montana.

(See also Figs. 10A, 14A and page 115.)

F:A.M.31782, *Rakomeryx raki* (or *zorakianus*), n.sp., ref., rev., from Green Hills, Barstow, California.

(See page 102.)

F:A.M.31522, *Yumaceras falkenbachii*, var., from Miami, Texas.

(See page 145.)

F:A.M.32134, 31673 (rev.) and 32104, *Yumaceras falkenbachii*, n.sp., ref., from Guymon, Texas County, Oklahoma. (F:A.M.32134, p₃ and p₄ germs.)

(See pages 145, 144.)

Col.M.200, *Yumaceras figginsi*, n.g. and sp., tentatively ref., rev., from Yuma County, Colorado.

(See page 144 [Col.M.214B].)

FIGS. 10 AND 10A. Maxillary dentitions, occlusal views compared.

× 1. 1, anterior cingulum; 2, posterior cingulum; 4, intercolumnar or accessory tubercle.

FIG. 10. F:A.M.32303, *Aletomeryx gracilis* Lull, ref., rev., from Antelope Creek, Cherry County, Nebraska.

(See also Fig. 16 and page 157.)

N.S.M.3-27-11-33, *Barbouromeryx trigonocorneus* (Barbour and Schultz), genotype (in part), from Dawes County, Nebraska.

(See also Figs. 5, 7 [mandibular dentition], 2, 14 [skull], 25 [limbs] and page 134.)

A.M.18956, (?) *Sinclairiomeryx riparius* (Matthew), type, from Sheep Creek, Sioux County, Nebraska.

(See page 165.)

P.U.10401, *Subdromomeryx antilopinus* (Scott), type, from Deep River, Montana.

(See also Figs. 14A [skull], 18 [limbs] and page 123.)

A.M.10953, *Cranioceras dakotensis*, n.sp., ref., rev., from east of Rosebud, South Dakota.

(See page 91.)

F:A.M.31250, *Cranioceras* (*Procranioceras*) *skinneri*, n.subg. and sp., subgenotype (in part), from Devil's Gulch, Brown County, Nebraska.

(See also Figs. 2, 11, 12 and page 86.)

F:A.M.31211, (?) *Drepanomeryx* species, ?ref., from Stonehouse Draw, Sioux County, Nebraska.

(See page 140.)

A.M.15584, *Palæomeryx kaupi* Meyer, ref. (detached), from Orleans, France.

(Compare mandibular dentition, A.M.15584 [different individual], Fig. 8.)

F:A.M.31283, *Cranioceras teres* (Cope), ref., from Santa Cruz, New Mexico.

(See page 93.)

FIG. 10A. F:A.M.31788A (rev.) and 31325, *Rakomeryx raki* (or *forakianus*), n.sp., ref., from Green Hills, Barstow, California.

(See also Figs. 8, 18 [F:A.M.31325, mandible, limbs] and page 104.)

F:A.M.31245, *Dromomeryx whitfordi* Sinclair, ref., rev., from Sioux County, Nebraska.

(See page 121.)

C.M.827, *Dromomeryx borealis* (Cope), ref., rev., from Montana.

(See also Figs. 9, 14A and page 115.)

F:A.M.31780, *Rakomeryx raki* (or *forakianus*), n.sp., ref., from Green Hills, Barstow, California. (Combined from both sides.)

(See page 102.)

F:A.M.31674 and 31676 (m^s only), *Yumaceras falkenbachii*, n.sp., ref., from Guymon, Texas County, Oklahoma.

(See page 145.)

FIG. 12. *Cranioceras* and *Procranioceras*.

× $\frac{1}{2}$ (dentition × 1). A, B, C, cross sections of horns; 1, vacuity; 2, supra-orbital foramen; 3, auricular depression.

N.M.2044, *C. teres* (Cope), type, from New Mexico.

(See page 92.)

F:A.M.31251, 31250 (subgenotype, in part) and 31253, *C. (P.) skinneri*, n.subg. and sp., from Devil's Gulch, Brown County, Nebraska.

(See also F:A.M.31251, Fig. 18 [doubtfully associated metacarpus]; F:A.M.31250, Figs. 10 [dentition], 2, 11 [cranium]; F:A.M.31253, Figs. 5, 7 [dentition]; and pages 87, 86.)

F:A.M.32065 (♀, rev.), 32064 (type), 32066 and 33710, *C. granti*, n.sp., from Leptarcus Quarry and ref. from Kat Quarry Channel, Cherry County, Nebraska.

(See pages 85, 84.)

A.M.17343, *C. unicornis* Matthew, genotype, from Sioux County, Nebraska.

(See page 82.)

FIG. 12A. *Cranioceras*, *Procranioceras*, *Yumaceras* and (?) *Drepanomeryx*.

× $\frac{1}{2}$. A, A', B, cross sections; 2, supra-orbital foramen.

Col.M.214, *Yumaceras figginsi*, n.g. and sp., genotype (posterior and lateral views), from Yuma County, Colorado.

(See page 143.)

F:A.M.31294, *Cranioceras pawniensis*, n.sp., type, rev., from Pawnee Creek, Colorado.

(See page 93.)

F:A.M.31264, *Cranioceras (Procranioceras) skinneri*, n.subg. and sp., ref., rev., from Devil's Gulch, Brown County, Nebraska.

(See page 87.)

F:A.M.31262 (?ref., rev.) and 31270 (ref.) of *Cranioceras granti*, n.sp., from Brown and Cherry Counties, Nebraska.

(See pages 86, 85.)

F:A.M.32458, 32463 (rev.), 32459 and 32466 (rev.), *Cranioceras clarendonensis*, n.sp., ref., from Clarendon, Texas.

(See page 95.)

F:A.M.32243, *Cranioceras mefferdi*, n.sp., type (in part), (supra-orbital horn-pedicle, rev., and occipital horn), from Cherry County, Nebraska.

(See page 89.)

A.M.18879, (?) *Drepanomeryx* species, ?ref., from Sioux County, Nebraska.

(See page 140.)

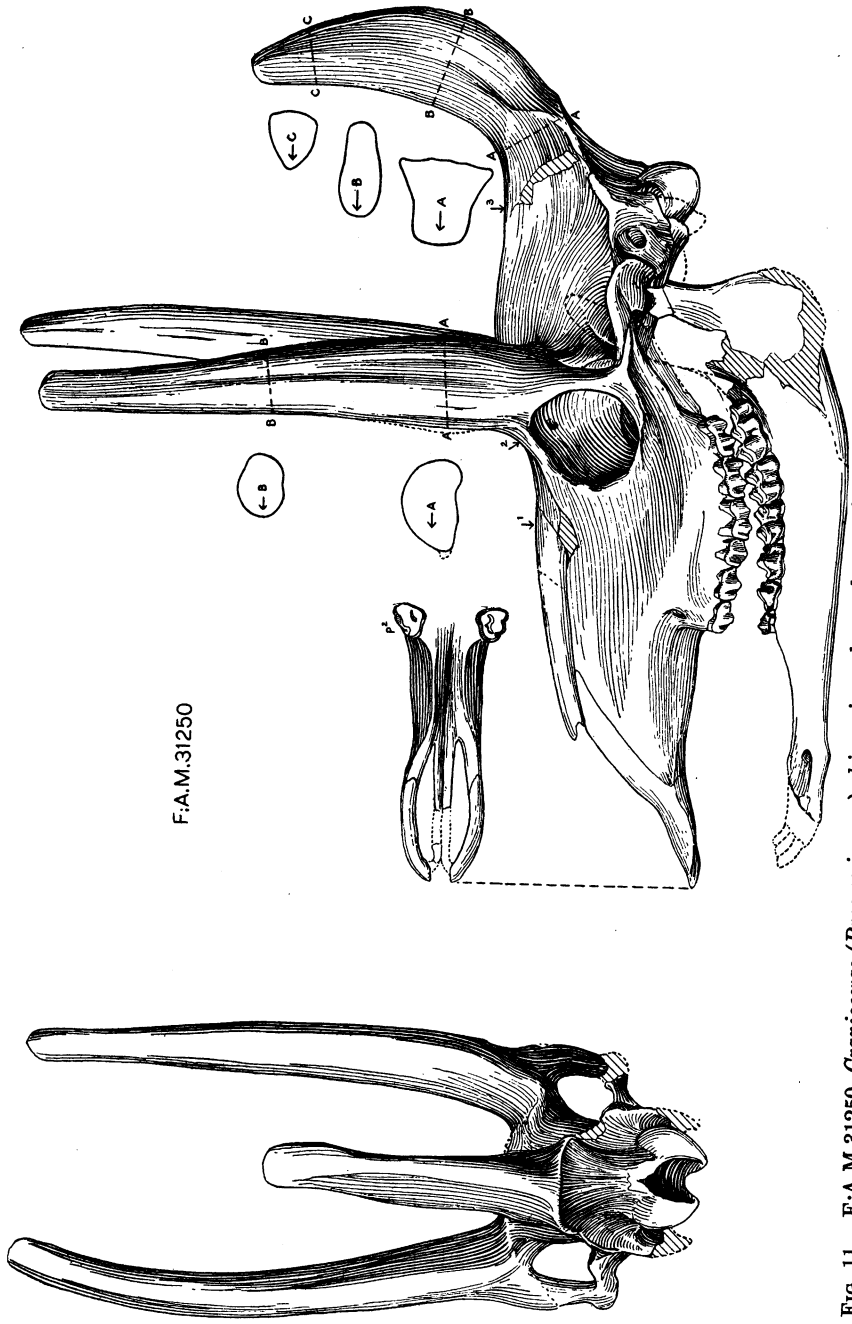


FIG. 11. F.A.M.31250, *Cranioceras (Procranioceras) skinneri*, n.subg. and sp., subgenotype, from Devil's Gulch, Brown County, Nebraska.
 × 1. A, B, C, cross sections of horns; 1, vacuity; 2, supra-orbital foramen; 3, auricular depression. (See also frontispiece [reconstruction π], Figs. 2 [cranium], 10, 12 [maxillary dentition] and page 86.)

DIVISION A.—DROMOMERYCINI

Subfamily 1.—*Craniocerotinae*

I. *CRANIOCERAS* MATTHEW

IA. *PROCranIOCERAS*, NEW SUBGENUS

Frontispiece, E; Figures 1B, 11, 12, 12A and (in part) 2, 3, 4, 4A, 5, 6, 7, 8, 10;
Limbs (in part) 17, 18

Statement

The subfamily is at present limited to the peculiar three-horn-pediced genus, *Cranioceras*, and the closely allied though less progressive subgenus, *Procranioceras*. The general characters of the genus and its interesting history in the literature are mentioned on a preceding page and need not be repeated here. While at first glance the *Procranioceras* cranium is not un-Antilocaprine-like, the dentition is typically of Cervid-Giraffid form. The broad sagittal area is posteriorly produced and elevated in the median, transversely-flattened and anteriorly-curving occipital horn; the paired erect frontal horn-pedicles of the male have a rotund cross section (and lack any basal flange); the orbits are relatively far forward; the premolars are moderate to large, the p_4 anterior fossette open, and the molars definitely brachyodont. In the genus proper, as compared to the subgenus, the occipital horn-core of the male is of rounder cross section, is directed more posteriorly and may be longer; the anterior premolars are shorter-proportioned and the molars taller-crowned. In the female the supra-orbital horns are absent and the third horn reduced to a slight elevation of the occipital area.

The *Procranioceras* skull follows the deer in differing from the prong-horn by the more anterior position of the orbit, the lower maxillæ, the narrower anterior muzzle, the slenderer premaxillary border, the wider incisive foramina and broader supra-occipital. The paired frontal appendages, which in form and anterior position seem to parallel the antelope rather than the deer, actually are highly specialized muntjac-like pedicles rather than Antilocaprine horn-cores. The skull, while at once more suggestive of *Dromomeryx* than of any more recent ruminant, differs widely from the latter in the more anterior position of the orbits, the erectness of the paired horn-cores, the absence of any

trace of the postorbital flange, and in the characters of the sagittal area, with its remarkable, backwardly directed, forwardly curved median-occipital horn.

Description of skull (see *Procranioceras skinneri*, F.A.M.31250 and 31251, Figs. 2, 11, 12): The dorsal profile slopes upwardly from the muzzle to the elevated bases of the paired horn-pedicles, is somewhat convex over the brain case, and thence is produced postero-upwardly and forwardly along the occipital horn. The slender tapering horn-pedicles, save for a slight inward bowing, stand erect over the posterior orbits. Moderately compressed laterally, particularly at the base, they have the external surface marked with veining. The notably "bulbous" pedicle tips are suggestive of a one-time corneous apex. The median occipital horn is strongly concave anteriorly and convex posteriorly, being anteroposteriorly broad in its median extent, but much compressed laterally and somewhat narrowed posteriorly. (It may be presumed hypothetically that this horn is formed of a union of bilaterally symmetrical elements of the supra-occipital and of the parietals.) The basicranial axis is angulated. The muzzle is relatively elongate and of slender, rounded cross section. The premaxilla-nasal contact is broad; the premaxillæ viewed inferiorly are extremely slender. Upper incisors and canines, dp_1 (i.e., p_1) are never developed. The anterior edge of the orbit lies above the middle of m^2 ; the posterior border, though prominent, is slender. The parietal crests are continued to the lateral bases of the occipital horn where they enclose a wide and anteroposteriorly concave area, marked medianly by the prominent depression of the auricular attachments. The usual supra-orbital foramina, lacrimal vacuities and suborbital foramina (above p^2 - p^3) are present. The incisive foramina of the anterior palate are slender and much elongated; the posterior palatal border is unproduced and the palatal width greatly restricted anterior to p^2 . The proportionately small occipital condyles are surmounted by a restricted and backwardly dished muscular concavity. The occipital processes are wide and the mastoid area prominent. The bullæ, in our material, are but partially preserved and the meatus are lost. The glenoid surface is furnished with a strongly elevated posterior margin. The zygomatic arches are slender and elongate. The diastema, as seen in the mandible, is moderate relative to the size of the teeth. The mandibular angle is broadly rounded and the condyle rather low. The condition of the inferior incisors and canines is shown by a Clarendon, Texas, mandible (F.A.M.33703) to have been much as in *Dromomeryx*. The premolars and molars are notably brachy-

odont. Compared to the last-named genus, the premolars tend to be proportionately larger, the p_4 anterior fossette is unformed, and the limb elements tend to be smaller, though seemingly of the same general proportions and there is no dp_1 (p_1).

The *Cranioceras unicornis* type horn is noticeably larger, heavier and directed more posteriorly, and the premolars, as seen in referred dentitions, are smaller than in *Procranioceras skinneri* from Devil's Gulch. The type ramus of *Dyseomeryx* (*Cervavus*) *sinclairi* Matthew, from the Snake Creek, is tentatively identified with *C. unicornis*. Other specimens from Sioux County of smaller size, but with similarly proportioned premolars, may represent smaller individuals of the one species. The lower molars are larger and the premolars notably reduced compared to the smaller type of *Procranioceras skinneri*. In *P. skinneri*, as compared to *Bouromeryx nebrascensis*, the molars are very much larger while the premolars are approximately the same size and, therefore, proportionately much smaller. There is doubt as to the reference of an interesting mandibular ramus from the uppermost zone of Sioux County. The specimen, while resembling referred *C. unicornis* and *C. granti* rami in the size and proportions of its teeth, differs from both in its relatively shorter postsymphysial distance. *Cranioceras granti*, from the stratigraphically high *Leptarctus* Quarry of Cherry County, in dentition and occipital horn tends to resemble the genotypic species from possibly equivalent beds of Sioux County. The species is named in honor of Madison Grant, explorer-naturalist. Remains from the stratigraphically intermediate Midway Quarry and other localities in Cherry County, are referred to a new species, *C. mefferdi*. For present convenience, specimens from the stratigraphically lower Valentine A Quarry and from Keya Paha and Box Butte County localities, which in size and general proportions closely resemble *P. skinneri*, are separately and questionably grouped under the latter. Referred limbs from the *Leptarctus* Quarry of Cherry County are extremely heavy-proportioned, approximating the largest Sioux County *Dromomeryx* material. *Cranioceras* limbs from Sioux County are intermediate to the last and to the largest of the limbs referred to *Procranioceras*.

Problems exist as to *C. teres* from New Mexico and *C. clarendonensis* from Texas. Referred ramal dentitions from the former area are remarkable through exhibiting a p_4 which differs from the typical *Cranioceras* pattern in the detached and not un-*Rangifer*-like condition of the inner middle column, and occasional Texas p_4 s may have the anterior fossette closed. Among the *Cranioceras*-like ramal dentitions from

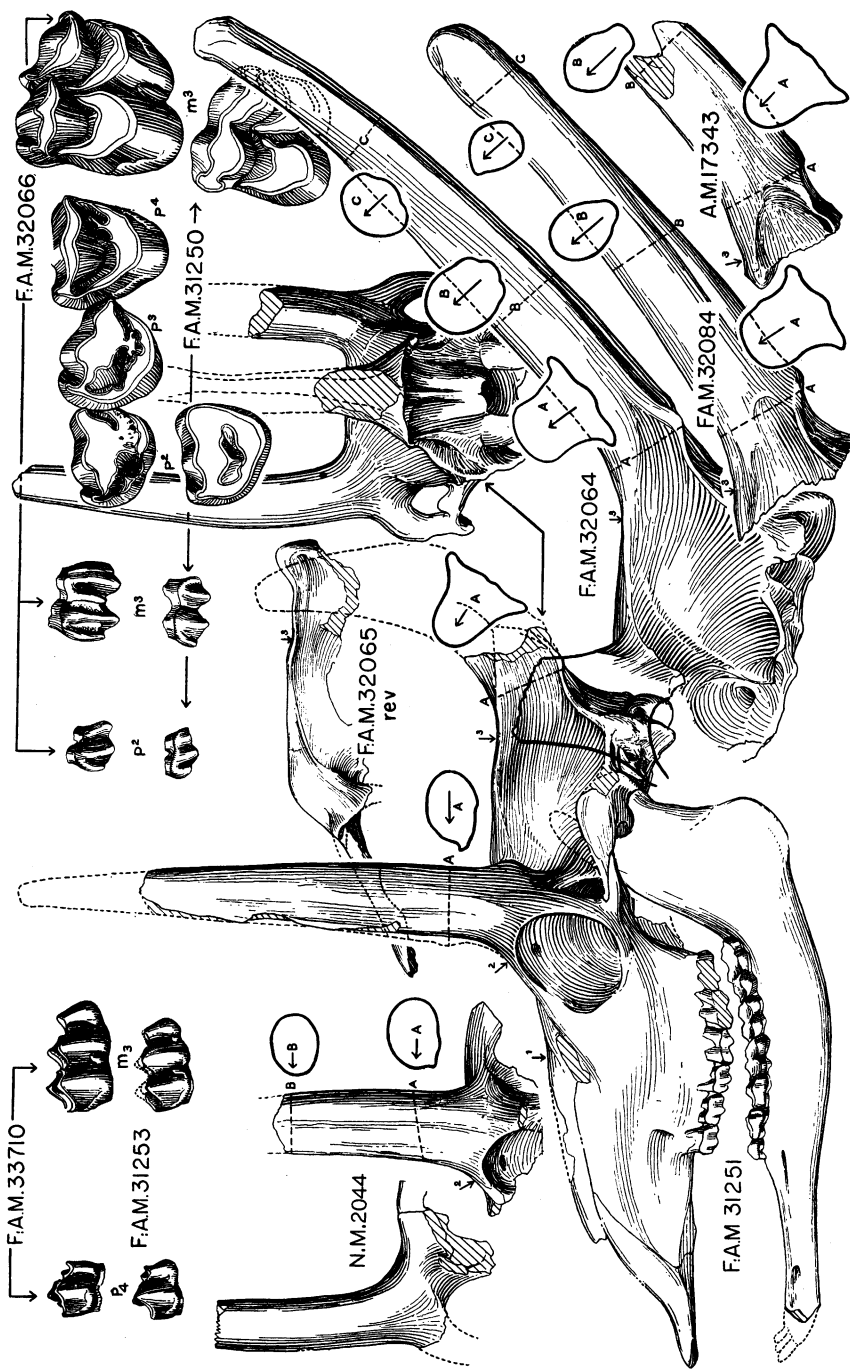


FIG. 12. *Cranioceras* and *Procranioceras* species, from the Late Tertiary of New Mexico and Nebraska.
 × ½ (dentition × 1). (See legend, page 73.)

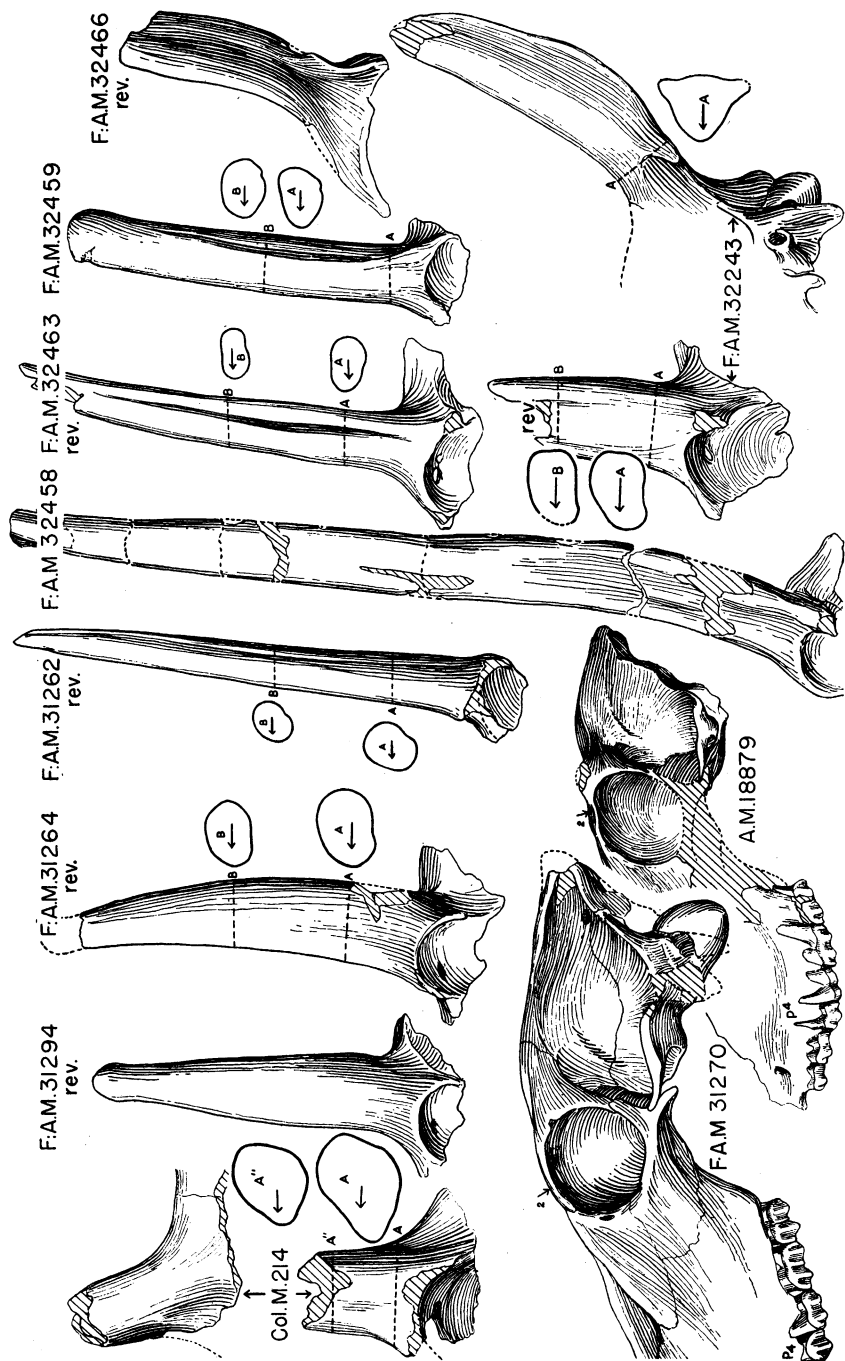


FIG. 12A. *Cranioceras* Matthew, *Procranioceras*, n.subg., and *Yumaoceras*, n.g. (Col.M.214), comparison of horn-pedicles from the Late Tertiary of Nebraska, Colorado and Texas.

(*Cranioceras* and (?)*Drepanomeriz* referred female skulls from Nebraska.)

× ½. (See legend, page 73.)

several Nebraskan localities, certain minor variations are observed in size, relative proportions of the premolars, premolar pattern and length of diastema. It is probable that some of these may be due to individual and sex variation. (A nearly equal variation seems to occur in both the Recent deer and pronghorn.) Unfortunately "horns" are poorly represented. A horn-pedicle from Colorado is not definitely separable from what appears to be an adolescent *Procranioceras* horn from Devil's Gulch, Nebraska (Fig. 12A). In marked contrast to the two latter heavy-proportioned and forwardly curving pedicles are the tall, slender and posteriorly directed horn-pedicles from Clarendon, Texas, and Quinn Ranch, Nebraska. Similarly the dentitions from Clarendon, in the stubby proportions of p_4 (at times closed condition of p_4 fossette) and tendency to taller-crowned molars with less marked folds, point to definite differentiation between the forms from later and earlier horizons. A horn-pedicle from Pawnee Creek, Colorado, is made the type of a species, *C. pawniensis*, and a ramus from South Dakota the type of a further distinct species, *C. dakotensis*. Smaller *Cranioceras* forms possibly may prove to be represented by the mandibular rami grouped on a later page under *Bouromeryx pseudonebrascensis*.

The ramal dentitions referred to *Cranioceras* are readily distinguishable from notably slenderer-proportioned dentitions with proportionately much smaller premolars and taller, less brachyodont-crowned molars, in which the "Palæomeryx" fold tends to be absent, described below under *Sinclairiomeryx*, n.g., and *Aleiomeryx* Lull.

Species of the genus and subgenus are recognized from Brown, Cherry, Box Butte and Sioux Counties, Nebraska, S. Dakota, Montana, New Mexico, Texas and Colorado. The largest and smallest forms are exemplified by Nebraskan remains. The known crania and several examples of the dentition are figured. For discussion and figures of limb elements, see page 169.

Summary of Named Species and Subspecies

The ten tentatively recognized species and subspecies, of which six are based on skulls or horns, one on an upper molar and three on ramal dentitions, are enumerated below:

Species (1) and (1a) are of the genus proper. Species (2) is of the subgenus, and to this are referred tentatively species (3) to (4a) and (6). Species (5) and (7) may or may not prove directly allottable to the genus.

- (1) *Cranioceras unicornis* Matthew, genotypic species, from Sioux County, Nebraska.

GENOTYPE.—Section of occipital horn-pedicle, A.M.17343. This paper, *Fig. 12*.

- (1a) *Cranioceras granti*, n.sp., from *Leptarctus* Quarry, Cherry County, Nebraska.

TYPE.—Posterior cranium, F:A.M.32064. This paper, *Fig. 12*.

- (2) *Cranioceras (Procranioceras) skinneri*, n.subg. and sp., from Devil's Gulch, Brown County, and questionably referred from Cherry, Keya Paha and Box Butte Counties, Nebraska.

SUBGENOTYPE.—Skull with horn-pedicles, left ramus and complete dentition, F:A.M.31250. This paper, *Figs. 2, 10, 11, 12*.

- (3) *Cranioceras mefferdi*, n.sp., from Cherry County, and questionably referred from Brown and (?) (3a) Dawes County, Nebraska.

TYPE.—Partial skull, F:A.M.32243. This paper, *Fig. 12A*.

- (4) *Cranioceras dakotensis*, n.sp., from vicinity of Rosebud Agency, South Dakota.

TYPE.—Right ramus, A.M.10952. This paper, *Fig. 7*.

- (4a) *Cranioceras kinseyi*, n.sp., from Montana.

TYPE.—Right ramus, Kinsey Coll. 3-6-1927.

- (5) *Cranioceras teres* (Cope), from New Mexico.

TYPE.—Cranial fragment with portions of horn-pedicles, N.M.2044 [F:A.M. cast]. This paper, *Fig. 12*.

- (6) *Cranioceras pawniensis*, n.sp., from Pawnee Creek, Colorado.

TYPE.—Right horn-pedicle, F:A.M.31294. This paper, *Fig. 12A*.

- (7) *Cranioceras clarendonensis*, n.sp., and (?)var., from Clarendon, Texas.

TYPE.—Right ramus, F:A.M.32454. This paper, *Figs. 4, 4A*.

REFERRED.—Cranial saddle with horns, F:A.M.32458.

- (7a) (?)*Cranioceras texanus* (Hay), from Navasota, Texas.

TYPE.—Right m³, College Station Collection.

Detailed Lists of Types, Referred Specimens, and Synonymy

Cranioceras, total available specimens, 322; numbered and listed, 272; uncatalogued, 50.

- (1) *Cranioceras unicornis* Matthew, genotypic species

From Sioux County, Nebraska

See description under preceding statement.

Cranioceras unicornis MATTHEW, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, p. 223, Fig. 19.

Cervavus sinclairi MATTHEW, 1918, *ibid.*, p. 218.

Blastomeryx (*Dyseomeryx*) *sinclairi* (MATTHEW) (in part), 1924, *ibid.*, L, pp. 194¹ and 198.²

GENOTYPE.—Section of occipital horn-pedicle.

A.M.17343

Collected from Snake Creek³ beds, E. Sinclair Draw, in 1916.

Figured by Matthew, 1918, Fig. 19; this paper, *Fig. 12*.

(Ramus, A.M.17344 [figured under 17144], tentatively referred by W. D. M. [1918], not of *Cranioceras*—now the type of *Prosynthetoceras siouxensis*, n. sp. [see page 607].)

¹ "Pawnee Creek beds" evidently in error for Snake Creek beds.

² Refers to species incomplete skull (A.M.18879) here tentatively referred to *Matthomeryx matthewi*.

³ Suggestive of "Hipparion Zone" but reported Snake Creek and, according to A. Thomson, possibly Sheep Creek.

REFERRED MANDIBULAR DENTITIONS.—

Six specimens collected by Jack Wilson:

Left fragment with p_2 (br.)— m_2 . (M+)	F:A.M.31200	From Sinclair Quarry, 1932. This paper, <i>Fig. 8</i> .
Left ramus, p_2 — m_3 . (w)	F:A.M.31869	From W. Sinclair Draw, 1936.
Right fragment with p_2 — m_3 . (M)	F:A.M.31205	From W. Sinclair Draw, 1932.
Left fragment with m_1 (br.) — m_3 . (M+)	F:A.M.31201	From W. Sinclair Draw, 1933.
m_2 and m_3 .	F:A.M.31201A and B	From E. Sinclair Draw, 1933.

Three specimens collected by Albert Thomson:

Right ramus with sym- physis, p_2 (br.)— m_3 . (w)	A.M.22384	From Sinclair Draw, 1927. This paper, <i>Fig. 6</i> . Formerly catalogued under "Neotragocerus?"
Left ramus with diastema and p_2 alveolus, p_2 — m_3 . (w+)	A.M.17338	1916.
Figured by Matthew, 1918, Fig. 17, as the type of <i>Cervavus sinclairi</i> , which becomes synonymous with <i>Cranioceras unicornis</i> . (W. D. M. [1918, p. 218], includes in type A.M.17337 and 17336.)		
Partial left ramus with p_2 — p_3 alveoli, p_4 — m_3 . (w)	A.M.17337	1916.

REFERRED MAXILLARY DENTITIONS.—

Left maxilla with p^4 — m^3 .	A.M.18880	From Sinclair Draw, 1921.
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See limbs, page 176.

REFERENCE QUESTIONED.—

Smaller specimen, molars approximating, but premolars smaller than in the Devil's Gulch remains:

Partial right ramus with p_2 — m_3 . (M+)	F:A.M.31204	From W. Sinclair Draw, 1933.
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Large specimen exceeding above F:A.M.31200 in size (probably generically distinct):

Left fragment with p_3 al- veolus and p_4 — m_2 . (w+)	A.M.21470	From "The Pits" S. of <i>Phio-</i> <i>hippus</i> Draw, 1925.
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From uppermost zone (resembles *C. granti*):

Left ramus with diastema, p_2 (br.)— m_3 . (w)	F:A.M.31868	From Olcott Quarry, 1936.
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(1a) *Cranioceras granti*, new species

From Upper Zone, Cherry County, Nebraska

Several extremely useful specimens lately secured from the upper zone point to a resemblance between the *Cranioceras* of this uppermost horizon and the genotypic species from Sioux County, as contrasted with the somewhat smaller, shorter-crowned and less specialized subgenus (*Procranioceras*) from the Devil's Gulch area. As previously remarked, the remains average larger, the molars are taller-crowned, the premolars relatively smaller and the cranial horn noticeably more elongate, rounder in cross section and more posteriorly directed than in *Procranioceras*. The female of the genus is indicated in a cranium and partial cranium from the same beds, in which the supra-orbital horn-pedicles are absent and the broad, flat and posteriorly produced sagittal area bears but a rudiment of the usual cranial horn (Fig. 12).

TYPE.—Posterior cranium with bases of paired supra-orbital horn-cores and depressed, notably elongate and straight cranial horn. F:A.M.32064 From *Leptartus* Quarry. Collected by the Morris F. Skinner party in 1936. This paper, *Fig. 12*.

[Horn twice as long (height above occipital depression, 244 mm. versus 122 mm.) and condyles larger (referred teeth less brachyodont and premolars smaller) than in *P. skinneri* type.]

REFERRED (five starred specimens with closed p_4).—

From type locality, 1936:

Left horn-pedicle, tip missing. (Specimen bent posteriorly as in <i>C. clarendonensis</i> ; basal cross section triangular, short anteriorly and rounded posteriorly.).....	F:A.M.
	34030

Five mandibular rami—tooth series tending smaller than *C. granti*, F:A.M.33714:

Left ramus with symphysis, p_2 - m_3 . (Symphysial distance tending long.).....	(w)	34031
Right ramus with symphysis, p_2 alveolus, p_3 - m_3 . (Symphysial distance tending short.).....	(M+)	34032
Left ramus with symphysis, p_3 alveolus and p_3 - m_3	(w)	34038
Left ramus with diastema, p_2 - p_3 alveoli and p_4 - m_3	*(M++)	34037
Left fragment with diastema, p_2 - m_1 (br.).....	(M)	34033

Two maxillæ:

Right maxilla with dp^2 - m^3 (erupting) and germs of p^2 - p^3	34039
Right maxilla with p^2 - m^3	(w++) 34034

From Kat Quarry Channel localities:

F:A.M.

Posterior end of cranium with occipital horn.	E.K. ¹	32084
Partial cranium with left supra-orbital horn-pedicle and basal half of cranial horn; dentition missing. (Heavy, stubby proportions of orbital horn-pedicle suggest adolescent individual.).....	W.K.	33709
Right supra-orbital horn-pedicle.....	E.K.	33719
Hornless skull with p ² -m ² , muzzle missing.. (w)	K.	31270
<i>Fig. 12A</i>		
Top of cranium showing border of orbit, large supra-orbital foramina, frontoparietal suture, auricular pit and abbreviated occipital horn of adolescent female.....	<i>Fig. 12</i> E.K.	32065

MANDIBULAR RAMI

Left ramus with incisive border-m ₃ . (p ₄ tending larger than in other specimens.) (M)	W.L.K.	33714
Left ramus with p ₂ -m ₃ *(M+)	W.L.K.	33715
Left ramus with diastema, alveoli and p ₄ -m ₃ (M+)	E.K.	33710
<i>Fig. 12</i>		
Left fragment with p ₂ -m ₃ (w+)	E.K.	33711
Right fragment with m ₁ -m ₃ (M+)	K.	31248
Unassociated m ₂ and m ₃	E.K.	32068B, A
Left fragment with incisive border-m ₃ (w)	Q.K.	33713A
Right ramus with p ₂ -m ₃ (br.). (Heavier proportions but size smaller, not much exceeding <i>P. skinneri</i> ; possibly female.).. *(w+)	Q.K.	33713

MAXILLARY DENTITIONS

Left maxilla with p ² -m ³ (w)	E.K.	32066
<i>Fig. 12</i>		
Left maxilla with p ⁴ (br.)-m ³ (w)	E.K.	32067
Detached p ²	E.K.	32068

RAMI, IMMATURE

Four immature rami.....	E.K.	33712, A-C
Right ramus with dp ₂ -m ₃	K.	31249
Left fragment with dp ₂ -m ₁	K.	31265

¹ K. = Kat Quarry Channel (collected 1931, 1932 and 1934).
E.K., Q.K., W.K., W.L.K., = East, Quarter, West and West Line Kat Quarry Channels (collected 1936).

From various localities (cited only in part in Table I):

(a) From Brown County:

Right horn-pedicle. F:A.M.31262 From Quinn Ranch, 1928.
This paper, *Fig. 12A*.
(Tall, slender, resembling Clarendon F:A.M.32463 versus *P. skinneri*.)

Right fragment of horn-pedicle. F:A.M.31263 From Deep Creek, 1933.

Right ramus with dp_4-m_3 and p_2-p_4 germs. F:A.M.31261 From Quinn Ranch, 1928.
(p_2 germ quite small.)

(b) From Cherry County:

Right fragment with p_2-p_3 alveoli and p_4-m_1 . F:A.M.31256 From Hans Johnson's Ranch, 1933.
(M+)

Right dp_2-m_2 (erupting). F:A.M.32086 From $1\frac{1}{2}$ mi. below Boiling Spring Bridge, 1934.

(Specimen is suggestive of F:A.M.31242, right dp_2-m_1 , from Snake Creek Quarry 1, horizon B.)

From Bear Creek, 1934:	F:A.M.
Left ramus with symphysis, p_2 alveolus and p_3-m_3	*(M) 32401
Right fragment with p_4-m_1	*(M) 32402
Immature left ramus with dp_2-m_1	32403
Left maxilla with p^2-m^3	(M) 32400

Referred limb elements from the same horizon are a little larger than those associated with the type of *Subdromomeryx antilopinus* (see Limb Section, page 177).

(2) C. (*Procranioceras*) *skinneri*, new subgenus and species

From Devil's Gulch, Brown County, and Questionably Referred from Cherry, Keya Paha and Box Butte Counties, Nebraska

The species has been discussed in the introductory statement. The remains are of smaller size than the average from Sioux and Cherry Counties, Nebraska.

SUBGENOTYPE.—Skull with F:A.M.31250 From Devil's Gulch, Horse
paired supra-orbital horn- Quarry, 1933.
pedicles and median occi- This paper, *Figs. 2, 10, 11, 12*.
pital horn, left ramus and
complete dentition. (M+)

REFERRED FROM TYPE AREA.—

Skull with broken paired pedicles and base of occipital horn, mandible, dentition; and doubtfully associated atlas and axis, right and left metacarpi (see Limb Section, page 177). (w+)	F:A.M.31251	1931. This paper, <i>Fig. 12</i> ; right metacarpus, <i>Fig. 18</i> .
Palate and detached horn-pedicles.	F:A.M.31252	1931.
Cranial fragment with right horn-pedicle (and ?occipital horn).	F:A.M.31264	1934 (and 1936). This paper, <i>Fig. 12A</i> .

Seven rami:

Partial left ramus with p_1 - m_1 . (M)	F:A.M.31253	1933. This paper, <i>Figs. 5, 7, 12</i> .
Right ramus with p_1 - p_3 alveoli and p_4 - m_3 (br.). (M)	F:A.M.31268	1934.
Left ramus with diastema, p_1 - p_3 alveoli and p_4 - m_3 . (M)	F:A.M.31269	1934.
Left fragment with p_4 - m_3 . (M)	F:A.M.31267	1934.
Left fragment with p_1 - m_3 . (M) (Smaller.)	F:A.M.31255	1929.
Right fragment with m_1 (br.)- m_3 . (M)	F:A.M.31258	(From Dutch Creek, 1929.)
Right ramus with dp_1 - m_2 (erupting).	F:A.M.31266	1934.

One maxillary specimen:

Right maxilla with dp_2 - m^2 (erupting).	F:A.M.31260	1933.
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See limbs, page 177.

TENTATIVELY REFERRED FROM CHERRY, KEYA PAHA AND BOX BUTTE COUNTIES.—

(a) From Valentine A Quarry, Cherry County:

Right ramus with diastema and p_1 - m_3 . (M+)	N.S.M.31-8-8-30
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(p_2 proportionately as reduced as in F:A.M.31250, p_4 posterior inner fold with peculiar loop, size approximating *P. skinneri* type specimen.)

Right p_1-m_1 .	N.S.M.8-11-8-30
Left m_1 .	N.S.M.2-16-7-31
Right ramus with sym- physis and dp_1-m_1 .	N.S.M.19-2-9-30
Left fragment with dp_1 - m_1 .	N.S.M.9-2-8-30
Right fragment with dp_1 - dp_1 .	N.S.M.19-29-7-30
Left maxilla with p^2-m^1 . (w)	N.S.M.16-8-9-31
Left dp^2-m^1 .	N.S.M.2A-16-7-31
Left p_1-m_1 . (M++) (Smaller.)	N.S.M.42-11-8-15
Left fragment with dp_1 - dp_1 .	N.S.M.8-5-8-30
Right fragment with dp_1 - dp_1 .	N.S.M.2-16-7-31

(b) From Keya Paha County:

Left m_1 (br.)- m_1 .	N.S.M.6-29-7-15
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(c) From Box Butte County:

Right ramus with p_1-m_1 .	N.S.M.2-28-6-33
Left dp_1-m_1 and premo- lars in germ.	N.S.M.1-28-6-33

The *P. skinneri* referred specimens from Box Butte and Keya Paha Counties are not cited on Table I.

(3) *Cranioceras mefferdi*, new species

From Cherry County, and Questionably Referred from Brown and Dawes Counties,
Nebraska

The dentition and the paired pedicle bases of the type are larger, the base and tip indicate a longer-proportioned pedicle and the cranial horn is notably sligher than in the *P. skinneri* type specimen. This cranium was secured in November, 1935, and, like the two crania from Devil's Gulch, was collected by Morris F. Skinner and his assistant, R.

L. Mefferd. The more recent evidence suggests that this species, from intermediate, *P. skinneri*, from earlier, and *C. granti*, from later horizons, may represent widely differing forms.

TYPE.—Fragmental skull with cranial saddle, bases of paired supra-orbital horn-pedicles, occipital area with slender cranial horn, and p^2-m^2 . (M+)	F:A.M.32243	From 1 mi. due N. of Nenzel Quarry, S. side of N.E. $\frac{1}{4}$ Sec. 19, T. 33 N., R. 32 W., near head of Spring Canyon. Stratigraphic horizon presumably equal to the Midway Quarry. This paper, <i>Fig. 12A</i> .
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TENTATIVELY REFERRED.—

(a) From Midway Quarry, Cherry County, 1934:

Right ramus with sym-physis and p_2-m_2 . (M) Size larger than largest Devil's Gulch specimens.	F:A.M.32367
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Two immature rami with dp_2-m_1 .	F:A.M.32375 and 32375A	This paper, <i>Fig. 3</i> .
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Slightly smaller:

Right m_1 .	F:A.M.32368
Right m_3 .	F:A.M.32368A

(See Limb Section, page 178.)

(b) From Brown County:

Right fragment with dp_2-m_2 (erupting).	F:A.M.31257	From Moore Creek, 1933.
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Right ramus and left sym-physis, p_2 alveolus and p_3-m_3 . (A)	F:A.M.31254	From Fairfield Creek, 1929.
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(c) From Burge Quarry, Cherry County, 1935:

Right dp_4-m_3 (erupting) and p_4 germ.	F:A.M.32085
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(d) From Nenzel Quarry (9 mi. S. of Nenzel), Cherry County, 1934:

Right m_2-m_3 . (M+)	F:A.M.32200
Right maxilla, p^4-m^2 . (w)	F:A.M.32199

(?) (3a) Var.—genus in doubt

From Survey Quarry, Dawes County, Nebraska

Collected by Ted Galusha, 1935

[Premolars unreduced, dp_1 (p_1) represented by alveolus, diastema length unknown. Reconsideration indicates possibly *Procranioceras*, (?) *P. galushi*, n.sp., definitely not *Cranioceras*.]

SEVEN RAMAL SPECIMENS		F:B:A.M.
Right ramus with p_2 - m_3	<i>Figs. 4, 4A</i> (M+)	32860
Left ramus with p_2 - p_3 broken, and p_4 - m_3	(W)	32861
Left ramus with p_2 - m_3 (br.).....	(M+)	32862
Right fragment with p_2 - m_3 (smaller).....	(M+)	32863
Left fragment with p_4 - m_3	(M)	32865
Left fragment with p_4 (br.)- m_3	(W)	32865A
Right fragment with m_1 - m_3	(M)	32865B

FOUR MAXILLARY SPECIMENS		
Left maxilla with p^2 - m^2	(M+)	32864
Left fragment with m^1 - m^2	(M+)	32864A
Left fragment with m^1 - m^2	(W)	32864C
Left fragment with m^2 - m^2	(M+)	32864B

Two ramal fragments, twenty upper and twenty-five lower detached teeth, F:B:A.M. Coll.

(4) *Cranioceras dakotensis*, new species

From Vicinity of Rosebud Agency, South Dakota

Cervus sp., MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 409.

Moderate-sized remains from an unknown horizon in the vicinity of the Rosebud Agency probably rather represent a Late Tertiary contemporary of *C. (Procranioceras) skinneri* than a Lower Miocene forerunner of the genus. The form is known through a ramus and a maxilla and other fragments secured by the American Museum expedition of 1903. The slightly worn teeth of the ramus (A.M.10952) exhibit the characteristic low crowns, molar folds and styles, and open p_4 of *Procranioceras*. The ramal teeth in size approximate the Devil's Gulch *P. skinneri*, large referred ramus (F:A.M.31253), but the premolars, particularly p_2 - p_3 , relative to the m_3 , which is larger than in F:A.M.31253, are smaller-proportioned than in the latter specimen. (Compared to the single available specimen of the European *Palæomeryx*, the premolars are notably small.) The remains include larger- and smaller-sized teeth, the larger being exemplified by the type ramus and the smaller by specimen A.M.10952C.

TYPE.—Right ramus with p_2 - m_1 . (M) A.M.10952 From vicinity of Rosebud Agency, 1903.
This paper, Fig. 7.

REFERRED SPECIMENS SECURED BY A.M.N.H. 1903 EXPEDITION.—

Three maxillæ approximating type in size, from three miles east of Rosebud:

Right maxilla, p^2 - m^1 . (M) A.M.10953 This paper, Fig. 10.
Right p^4 - m^3 . (M) A.M.10954
Right maxilla, p^3 - m^1 . (w++) A.M.10955

Smaller-sized than type (approximating smallest of Valentine Railway Quarry A):

Left fragments with p_3 - m_1 and m_2 (br.)- m_3 . (w++) A.M.10956
Left fragment, m_2 - m_3 . (M) A.M.10952C
Right m_3 (M+) and p^4 (w). A.M.10952A and B
See metatarsus, page 178.

QUESTIONABLY REFERRED (tending subhypsodont).—

Right m^3 . A.M.10957 Big Spring Canyon, 1903.

(4a) *Cranioceras kinseyi*, new species

From Lower Madison Valley Beds, Montana

The genus is recognized in a mandibular ramus from Montana, placed at the writer's disposal through the kindness of C. A. Kinsey of Belgrade, Montana, and in a partial cranium, collected by Charles Falkenbach.

TYPE.—Right ramus with diastema, p_2 root- m_3 . (w+) Kinsey Coll. 3-6-1927 From Lower Madison Valley Beds.

REFERRED.—

From Deep River, 7 miles S.E. of Fort Logan, 1925: A.M.
Right fragment with p_3 - m_3 . (w+++)
Right fragment with p_2 - m_1 (br.). (w+)
Right fragment with p_3 (br.)- p_4 . (M+)

From north end of N. Boulder Creek, 1936:

Portion of palate and dentition with left orbit and root of horn-pedicle, associated with basioccipital area and partial right mandibular dentition. (Not included in count.) F:A.M.
(w++) 34193

(5) *Cranioceras teres* (Cope)

From New Mexico

Cosoryx teres COPE, 1874, Proc. Acad. Nat. Sci. Phila., XXVI, p. 150; Ann. Rept. Chief of Engineers, II, Pt. II, Extract from Appendix FF, p. 129.

Dicrocerus teres COPE, 1875, Proc. Acad. Nat. Sci. Phila., XXVII, p. 257; 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, pp. 347, 356, Pl. LXXXI, Fig. 7; Pl. LXXXII, Fig. 6.

Palæomeryx teres (COPE) [according to GIDLEY], 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, pp. 31, 33.

TYPE.—Fragment of top of cranium with portions of horn-pedicles.	N.M.2044 [F:A.M.cast]	From the Santa Fé marls. Figured by Cope, 1877, Pl. LXXXI, Fig. 7; Pl. LXXXII, Fig. 6; this paper, <i>Fig. 12</i> .
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The fragmental type specimen, which so far as observable is suggestive of *Cranioceras*, eventually may prove to have outstanding characters of its own. As observed above, the three more moderately worn of the five referred ramal dentitions from this area are remarkable through differing from the Nebraskan *Cranioceras* remains in the detached and *Rangifer*-like condition of the p_4 median column. The several rami exhibit a moderate variation in size, a specimen from the generally later deposits of the upper Rio Grande being the smallest.

REFERRED.—

Fragment of frontal with portion of right horn base.	F:A.M.31279	From ?Santa Cruz.
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TENTATIVELY REFERRED FROM SANTA CRUZ, NEW MEXICO (remains under (b) and (bb) probably of distinct forms).—

(a) Size somewhat exceeding F:A.M.31250 from Devil's Gulch:

Partial right ramus, posterior symphysis, p_2 alveolus, and p_1 - m_3 (br.). (w)	F:A.M.31286	From red layer, 1927.
Right fragment with p_3 - m_3 . (M)	F:A.M.31284	From red layer, 1927. This paper, <i>Fig. 8</i> .
Left ramus with p_2 (br.)- m_3 . (w++)	F:A.M.31289	From second wash, red layer, 1930.
Left fragment with m_1 - m_3 (br.). (w)	F:A.M.31281	From red layer, 1925.

Partial left immature ramus with dp_2-m_1 .	F:A.M.31282	
Left fragment with p_2 (br.)- m_2 . (w++)	F:A.M.31285	From red layer, 1927. This paper, <i>Fig. 6</i> .
Left maxilla with p^2-m^3 . (M+)	F:A.M.31283	From "green." This paper, <i>Fig. 10</i> .
Partial right maxilla with m^1-m^3 . (w+)	F:A.M.31287	From red layer, 1927.

(b) Size smaller than F:A.M.31250, teeth slenderer:

Partial left ramus with p_2 (br.)- m_3 . (M+)	F:A.M.31280	From second wash, 1931. This paper, <i>Figs. 6, 8</i> .
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(bb) Specimen from Rio Grande slope with smaller-proportioned p^4 :

Left p^4-m^3 . (M)	F:A.M.31288	1930.
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See limbs, page 179.

(6) *Cranioceras pawniensis*, new species

From Pawnee Creek, Colorado

The collections of the John C. Blick Colorado party include a horn-pedicle with attached portion of frontal bone. The specimen is very similar to a specimen from Devil's Gulch (F:A.M.31264) which is interpreted as representing a somewhat immature individual of *Cranioceras*. The pedicle is less elongate, somewhat thicker-proportioned in the mid-extent, and more attenuated distally than in the mature specimens. The tip is of the characteristic bulbous form. [Note the differences between this specimen and the taller and slenderer horn-pedicle from Quinn Ranch (F:A.M.31262) which may be of an adolescent individual of the Clarendon stage.] No *Cranioceras*-like teeth other than those of the smaller-sized remains described as *Bouromeryx pawniensis* have been found at Pawnee Creek.¹

TYPE.—Right horn-pedicle on frontal fragment.	F:A.M.31294	From "west of buttes, middle horizon," 1931. This paper, <i>Fig. 12A</i> .
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See referred limbs, page 179.

¹ No record exists of the Pawnee Creek specimens mentioned, but not enumerated, by Matthew (1904) under *Palæomeryx* species. Bull. Amer. Mus. Nat. Hist., XX, p. 129.

(7) *Cranioceras clarendonensis*, new species

From MacAdams Quarry, Clarendon, Texas

Figures 3, 4, 4A, 12A (in part)

The characters of the permanent and deciduous teeth of a number of specimens, secured in the Clarendon beds early in 1935, resemble *Cranioceras*. The size varies from slightly smaller to larger than the remains from Devil's Gulch. Two specimens (F:A.M.32211 and 31374), in which the p_4 is unworn, are interesting in exhibiting a partially closed anterior fossette. While the same fossette is closed in two of the worn specimens (F:A.M.31373 and 31372), in other worn specimens of otherwise similar character the fossette seems to have been open. The symphysis of specimen F:A.M.32212 is slenderer than in any of the Devil's Gulch rami, but the molars are of *Cranioceras* proportions, being larger than in the Colorado *Bouromeryx*. An immature maxillary, F:A.M.32425, and ramal series, F:A.M.32213, respectively resemble Devil's Gulch specimens, F:A.M.31260 and 31257. Larger individuals are exemplified by the type, F:A.M.32454 (Figs. 4, 4A), and conspicuously smaller-sized individuals by a ramus, F:A.M.32455 (Figs. 4, 4A). One specimen, F:A.M.32415, is but doubtfully referred to the species. Since these lines were sent to the press, the Clarendon field party has secured an extremely interesting cranial saddle with tall paired horn-pedicles attached, a second cranial fragment bearing a similar pedicle, a third skull fragment with a very slender but less markedly elongate pedicle (?adolescent), a fourth specimen with a stubby post-like and non-tapering horn-pedicle (compare Fig. 12A) and additional mandibular rami. The first two and, in less degree, the third of the horn-pedicles differ from the *P. skinneri* type in their greater height and slenderness.

Possibly taller supra-orbital pedicles and slighter occipital horns may prove to be characteristic of such relatively late horizons as Clarendon. The heavy post-like pedicle (F:A.M.32459) may belong to a distinct species if not genus. A dental stage paralleling *C. granti* is suggested by the above-noted mandibular rami with closed p_4 fossettes.

TYPE.—Right ramus with symphysis and p_2 - m_3 F:A.M.
 (M+) 32454
 Figs. 4, 4A

REFERRED FROM TYPE LOCALITY, 1934-35.—

HORN-PEDICLES

Portion of top of cranium with both horn-pedicles (tall and crushed).....	Fig. 12A	F:A.M. 32458
Fragment of cranium with left horn-pedicle (tall and crushed).....		32458A
Right horn-pedicle (tall and extremely slender) and frontlet..	Fig. 12A	32463
Crushed occipital horn with fragment of skull.....	Fig. 12A	32466
Left horn-pedicle (short and uncrushed) on cranial fragment (specimen of noticeably different form from <i>P. skinneri</i> and probably of a distinct genus—see ramal fragment F:A.M.32415 below).....	Fig. 12A	32459

TWENTY-SIX MANDIBULAR DENTITIONS

Starred specimens indicate p_4 with formed anterior fossette. The form of the fossette, especially as seen in F:A.M.32455, is suggestive of *Dromomeryx* rather than *Cranioceras*—see above.

Larger individuals (size of type):

Left ramus with p_2-m_3	(M)	32211
Left ramus with p_2-m_3	*(M+)	31373
Right ramus with symphysis and p_2-m_3 (br.).....	(M+)	33704
Left ramus with diastema and p_2-m_3 (br.).....	(M+)	33705
Right fragment with p_2-m_3	(w)	33706
Right fragment with p_2-m_3	(M+)	33707
Right ramus with p_2-m_3	(w+)	31372
Right ramus with p_2-p_3 alveoli and p_4-m_3	(w)	31372A
Left crushed ramus with symphysis, /Is and /C- m_3	(w+)	31371
Right fragment with symphysis, p_2-p_3 alveoli and p_4-m_1 ...	(M+)	32456
Right fragment with p_2-m_3 (br.).....	*(M+)	33708
Right fragment with p_4-m_3 (br.).....	(w)	32415A
Right ramus with p_2-m_3	(w)	32412
Four fragmental rami (32413 from Pegran Place).....		32413,
		32414, 32415B, 32212A

Smaller individuals:

Right ramus with diastema and p_2-m_3	*(M)	32455
	Figs. 4, 4A	
Left ramus with symphysis and p_2-m_3	*(w)	33700
Right ramus with symphysis and p_2-m_3 (br.).....	(M+)	32455A
Left ramus with diastema and p_2-m_3	(w+)	32212

		F:A.M.
Mandible with diastema and p_2-m_3	(w+)	31370
Left fragment with p_2-m_3	*(M+)	33701
Left ramus with diastema and p_2-m_3 (p_3 missing).....	*(M+)	31374
Left ramus with p_2-m_3	(w)	33702
Right ramus with symphysis, I_2-m_3	(w+)	33703

FIFTEEN MAXILLARY DENTITIONS

Larger individuals:

Right maxilla with p^2-m^3	(-M)	32422
	<i>Fig. 4A</i>	
Left maxilla with p^2-m^3	(M)	32422A
Right maxilla with p^2-m^3	(M+)	32422B
Left maxilla with p^2-m^3	(M)	32417
	<i>Fig. 4A</i>	
Right maxilla with p^2-m^3	(w)	32424
Right maxilla with p^2-m^3	(-M)	32424A
Left maxilla with p^2-m^3 (this and the following specimen slightly largest of the series).....	(M+)	32418
Right maxilla with p^2-m^3	(w+)	32418A
Right m^1-m^3	(M)	32419
Left p^2-m^1 (p^2-p^3 large and with external styles).....	(M)	32411
Right p^2-m^3	(M)	32421
Left p^4-m^3 (br.).....	(w)	32419A

Smaller individuals:

Right maxilla with p^2-m^3	(M+)	32423
Left p^4-m^3	(w)	32423A
Right m^1-m^3	(w+)	32423B

TEN IMMATURE MANDIBULAR DENTITIONS

Larger individuals:

Mandible with /C and p_2 alveoli, dp_2-m_3 (erupting).....	32213
Two ramal fragments with dp_2-m_1 and maxillary fragment with dp^3-dp^4	32218
Left ramus with dp_2-m_3 (erupting).....	32214
Right fragment with dp_2-m_2 (erupting).....	32410
Right fragment with dp_4-m_2 and germ of p_4	32416
Right fragment with dp_2-m_1 (erupting) (teeth broken).....	32217
Right fragment with dp_2-m_1	32217A

Smaller individuals:

Right ramus with diastema and dp_2-m_3 (erupting).....	<i>Fig. 3</i>	32216A
Right ramus with dp_2-m_2 (erupting).....		32216B
Left fragment with dp_4-m_3 (erupting) and p_4 germ.....		32216

SIX IMMATURE MAXILLARY DENTITIONS

Larger individual:	F:A.M.
Right maxilla with dp^3-m^3 (erupting)	32425
Smaller individuals:	
Left maxilla with dp^2-m^2 (erupting)	32215
Right maxilla with p^2 and dp^3-m^3	32215A
Left maxilla with dp^3-m^2	32215B
Two fragmental maxillæ	32420,A

See limbs, page 179.

(?)Larger Variety

From Clarendon

A larger-sized specimen, from the same exposure as the above remains, indicates the presence of a distinct form. While the molars are considerably longer anteroposteriorly than in the above specimens, the p_4 is no larger and is widely open anteriorly, the peculiar reduction of the posterior edge of the inner column recalling *Rakomeryx* of Barstow. The specimen is held for the time being as indeterminate. (Compare indeterminate horn, F:A.M.32459, p. 95.)

Right fragment with p_4 - F:A.M.32415
 m_3 . (M)

(7a) (?)Cranioceras texanus (Hay)

From Navasota, Texas

Dromomeryx texanus HAY, 1924, Proc. Biol. Soc. Wash., XXXVII, p. 15, Pl. II, Figs. 8-12.

TYPE.—Molar, upper right. College Station Figured by Hay, 1924, Pl. II,
Collection Figs. 8 and 9.

REFERRED FROM TYPE LOCALITY.—

Etc. molars. College Station
Collection

(*Dromomeryx* ? *angustidens* Hay, 1924, p. 16, Pl. II, Figs. 6 and 7, possibly a camelid.)

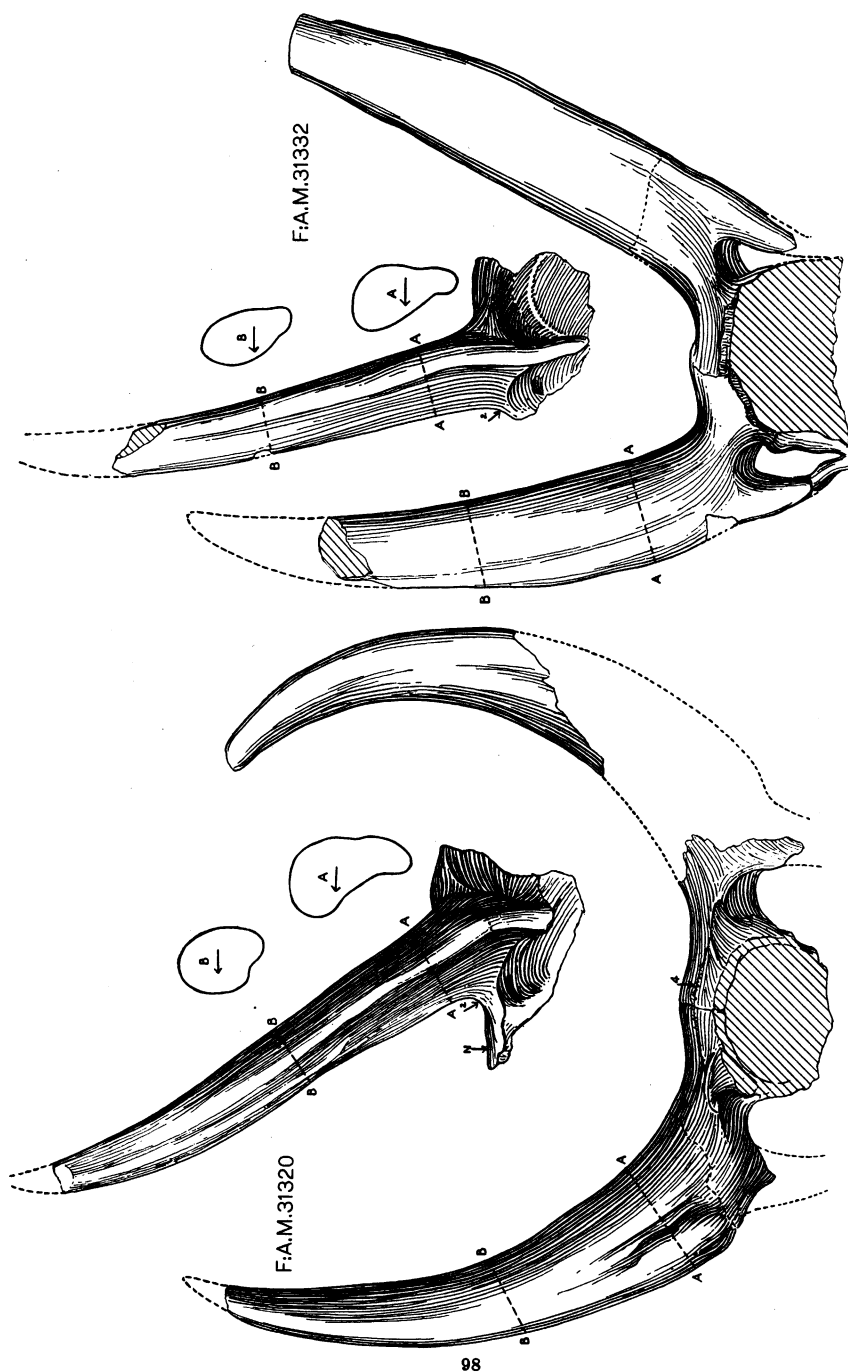


FIG. 13. F.A.M. 31320, *Rakomerys raki*, n.g. and sp., genotype, and F.A.M. 31332, *R. jorakianus*, n.sp., type, from the Late Tertiary, Green Hills, Barstow, California.
 × 1. A, B, cross sections; N, nasal; 2, supra-orbital foramen; 4, frontoparietal suture. (See pages 101, 105.)

Subfamily 2.—**Dromomerycinae**II. **RAKOMERYX**, NEW GENUSIII. **DROMOMERYX** DOUGLASSIIIA. **SUBDROMOMERYX**, NEW SUBGENUS

The characters of the genera and subgenera, *Rakomeryx*, *Dromomeryx* and *Subdromomeryx*, have been touched on in the discussion, page 48. The males of the subfamily are provided with basally flanged horn-cores that are bowed and directed anteriorly.

II. **RAKOMERYX**, NEW GENUS

Figures 2D, 13 and (in part) 3, 6, 8, 9, 10A; Limbs (in part) 18

Statement

The genus has been discussed briefly on a preceding page. The genotypic species, *Rakomeryx raki*, is based on a portion of a cranium with anteriorly tilted and strongly bowed supra-orbital horn-pedicles from the Mojave Desert, California. The horn-pedicles distally are much attenuated; proximally, and as viewed from in front, they are concave with a lateral enlargement suggestive of an adaptation of the Dromomerycine flange. A questioned species, *R. jorakianus*, is based on a second cranial specimen from the same Green Hills horizon, in which the horn-pedicles (unfortunately crushed) lack the characteristic tilting and bowing of the first specimen.

The teeth associated with the two cranial specimens are too fragmentary for definite comparison with the some fifty-odd dentitions and partial dentitions secured from the same beds, and ostensibly representative of one or both species. While the better preserved of these dentitions exhibit the same short crowns, cingular folds and intercolumnar styles occurring in *Dromomeryx*, they tend to differ from the latter in the smaller proportions of the lower premolars, p_2 and p_3 . However, the postsymphysial to p_2 distance, which is exhibited in three of the rami of the best represented Green Hills subgroup (unrepresented in other specimens), tends to be of the general proportions of *Dromomeryx*. As in the latter, there is a tendency toward molariformity in the p_4 , the an-

terior fossette in the best preserved specimen (F:A.M.31328) being closed, and to retention of the dp_1 , as indicated by the alveolus preserved in two specimens.

A third *Rakomeryx* species, *R. yermensis*, is seen in a few specimens from the deposits near Yermo, correlated with the First Barstow Division. The premolars are slender and somewhat different, particularly as seen in the p_3 , from the Green Hills remains. The Yermo specimens are of moderate to moderately small size. Two additional species of the genus are indicated in fragmental remains from Virgin Valley, Nevada, and from southeastern Oregon.

The occurrence of a *Dromomeryx*-like form in the Barstow area was noted by John C. Merriam (1919, p. 524), who recorded under "*Dromomeryx* or *Cervus?*, n.sp." a dp_4-m_1 (U.C.21218) and p_4-m_1 (broken) (U.C.21219), observing that the particular specimens "differ from *Dromomeryx* in entire absence of the palaeomeryx fold. . ."

The Barstow dentitions, as seen in the lower molars, indicate individuals ranging in size from the largest *Dromomeryx* to the smallest *Cranioceras*. Definite allocation of the large series of dentitions from the type horizon to the two Barstow species, based on the horns, is unwarranted because of the lack of absolute association, and these dentitions are, while waiting further evidence, held under (a) to (d)—the intermediate-sized remains being by far the commonest. The small-sized dentitions include a maxillary and mandibular series associated with a hornless cranium, here interpreted as representing a female. A form further differing from the last is suggested by a ramal fragment carrying a very slender p_2-p_4 (F:A.M.31324).

(For data and figures regarding the limbs, see page 169.)

Summary of Named Species

Three Barstow species:

- (1) *Rakomeryx raki*, n.g. and sp., from the Green Hills, Barstow, California.

GENOTYPE.—Top of cranium, ?associated m², etc., F:A.M.31320. This paper, *Fig. 13*.

- (2) *Rakomeryx jorakianus*, n.sp., from the Green Hills, Barstow, California.

TYPE.—Crushed posterior cranium and ?associated right maxilla, F:A.M.31332. This paper, *Fig. 13*.

- (3) *Rakomeryx yermonensis*, n.sp., from the vicinity of Yermo, Mojave Desert, California.

TYPE.—Mandible, F:A.M.31800. This paper, *Fig. 8*.

Two questioned species from Nevada and Oregon:

- (4) *Rakomeryx* species, from Virgin Valley, Nevada.

EXAMPLE.—m/ (broken), U.C.10676.

- (5) *Rakomeryx gazini*, n.sp., from southeastern Oregon.

TYPE.—Partial left horn-pedicle, C.I.T.351.

Detailed Lists of Types, Referred Specimens, and Synonymy

Rakomeryx, total available listed specimens, 68.

- (1) ***Rakomeryx raki***, new genus and species

From Green Hills, Barstow, California

Dromomeryx or *Cervus*? MERRIAM, 1919, Univ. Cal. Pub. Bull. Dept. Geol., XI, p. 524, Figs. 136, 137.

GENOTYPE.—Top of cranium with left and tip of right horns, and questionably associated m² and fragments of pelvis and ribs. F:A.M.31320 1927. This paper, *Fig. 13*.

(The associated m² is of the "moderate" size section.)

REFERRED DENTITIONS (MAY INCLUDE SPECIMENS OF *R. jorakianus*) FROM THE GREEN HILLS.—

(a) Largest size. (Lower molars approximating smallest *Dromomeryx*.)

Three specimens:

Partial mandible with p_2 - m_3 . (M+)	F:A.M.31782	1929. This paper, <i>Fig. 9</i> .
Left and right maxillæ with p^2 - m^3 . (M)	F:A.M.31780	1931. This paper, <i>Fig. 10A</i> .
Right fragment with p_3 - m_3 . (w)	F:A.M.31345	1924.

(b) Moderate size.

(The postsymphysial distance preserved in four specimens, F:A.M. 31353, 31340, 31341 and 31342.)

Eighteen mandibular dentitions:

Mandible with symphysis and p_2 - m_3 . (M++)	F:A.M.31353	1936.
(See associated maxilla below.)		
Mandible with symphysis and p_2 - m_3 . (w)	F:A.M.31340	1927.
Partial mandible with p_2 - m_3 . (w+)	F:A.M.31346	1930.
Right ramus with symphysis and p_2 - m_3 . (w)	F:A.M.31341	1930. This paper, <i>Figs. 6, 8</i> .
Left fragment with p_2 - m_3 . (w)	F:A.M.31343	1930.
Left fragment with p_4 - m_3 (m_1 and m_3 br.). (M)	F:A.M.31801	1932.
Partial right ramus with m_1 - m_3 . (w)	F:A.M.31344	1924.
Right ramus with symphysis and p_4 - m_3 . (w+)	F:A.M.31342	1924.
Right fragment with p_4 - m_3 . (w)	F:A.M.31805	1931.
Left fragment with p_2 - m_3 . (M)	F:A.M.31328	1934.
Left fragment with p_2 - m_3 . (w)	F:A.M.31329	1934.

Left fragment with p_4 - m_3 (teeth broken). (w)	F:A.M.31330	1928.
Left fragment with p_4 (br.) - m_3 . (w+)	F:A.M.31347	
Left fragment with m_2 - m_3 . (M)	F:A.M.31806	1924.
Left fragment with m_2 - m_3 . (M)	F:A.M.31807	1931.

/ms approximating largest size (maxillary dentition as yet unrecognized):

Left ramus with p_2 - m_2 and partial m_3 . (M)	F:A.M.31323	1931.
Left fragment with p_2 - m_2 and partial m_3 . (M)	F:A.M.31784	1931.
Right fragment with p_4 - m_3 . (M+)	F:A.M.31785	1931.

Eight maxillary specimens:

Left maxilla with p^2 - m^3 . (M++)	F:A.M.31353	1936.
(See associated mandible above.)		

Right maxilla with p^2 - m^3 . (M)	F:A.M.31327	1934.
--	-------------	-------

Left maxilla with p^2 - m^3 . (w)	F:A.M.31789	1931.
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(Note no intercolumnar styles.)

Right maxilla with p^3 - m^3 . (M+)	F:A.M.31790	1931.
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Partial right maxilla with m^1 - m^3 . (w)	F:A.M.31333	1930.
--	-------------	-------

Partial right maxilla with m^2 - m^3 . (w)	F:A.M.31794	1931.
--	-------------	-------

Partial right maxilla with m^2 - m^3 (br.). (w)	F:A.M.31334	1924.
---	-------------	-------

Partial right maxilla with p^3 - p^4 and m^2 - m^3 . (w+)	F:A.M.31332	1931.
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(Presumably associated with horns of type of *R. jorakianus*, see page 105.)

Five detached upper teeth:

Detached right and left m ² s.	F:A.M.31795	1924.
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Detached left m ² -m ³ .	F:A.M.31335	1924.
--	-------------	-------

Detached m ² (large).	F:A.M.31320	1927.
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(Possibly camelid—associated with the type of remains of *R. raki*, see page 101.)

Two immature maxillæ:

Partial right maxilla with dp ² -m ¹ .	F:A.M.31336	1930.
---	-------------	-------

Partial right maxilla with dp ² (br.)-dp ⁴ .	F:A.M.31337	1924.
---	-------------	-------

(c) Moderately smaller size.

Five dentitions:

Partial skull (crushed) with p ² -m ² , and mandible with p ₂ -m ₂ (p ₂ -p ₂ br.). (M+)	F:A.M.31325	From bottom of Green Hills, 1929. This paper, <i>Figs. 8, 10A.</i>
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(Hornless and probably female.)

(See associated limb elements, page 179. This paper, *Fig. 18.*)

Right fragment with p ₂ - m ₂ and possibly associated right maxilla with p ² -m ² . (M)	F:A.M.31788 and A	1931. This paper, <i>Fig. 10A</i> (maxilla).
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Left fragment with p ₂ -m ₂ . (W)	F:A.M.31322	1924.
--	-------------	-------

Right fragment with p ₂ -p ₄ . (M+)	F:A.M.31326	1930.
--	-------------	-------

Partial left maxilla with p ⁴ -m ² . (W+)	F:A.M.31792	1932.
--	-------------	-------

(cc) Slightly smaller than above, size approximating smallest *C. granti* (F:A.M. 33713).

Right fragment with p ₂ and m ₁ -m ₂ . (M+)	F:A.M.31808	1928.
---	-------------	-------

(d) Slenderer premolars.

Right fragment with p ₂ - p ₄ . (M+)	F:A.M.31324	1924.
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Two tentatively referred immature rami:

Right ramus with dp_1 al- veolus and dp_2-m_2 (erupt- ing).	F:A.M.31338	1930.
Right ramus with dp_2-m_2 .	F:A.M.31339	1934.

PROBABLY REFERABLE, TWO SPECIMENS RECORDED UNDER *Dromomeryx* OR *Cervus*?
MERRIAM (1919).—

dp_4-m_1 .	U.C.21218	Figured by Merriam, 1919, Fig. 136.
p_4-m_1 (br.).	U.C.21219	Figured by Merriam, 1919, Fig. 137.

(See Limb Section, page 179.)

(2) *Rakomeryx jorakianus*, new species

From Green Hills, Barstow, California

TYPE.—Crushed posterior cra- nium with both horn-pedi- cles, and questionably asso- ciated right maxilla with p^2 - p^4 and m^2-m^3 .	F:A.M.31332	From Lower Green Hills, $\frac{1}{2}$ mile west of camp. This paper, <i>Fig. 13</i> (horns).
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(The maxillary teeth, presumably associated with this specimen and which are much worn, are referable to the moderate-sized section represented by the commoner rami. As noted above, certain of the specimens referred to *R. raki* may pertain to this species.)

(3) *Rakomeryx yermonensis*, new species

From the Vicinity of Yermo, Mojave Desert, California

TYPE.—Mandible with p_2-m_3 . (M+) (Size moderate.)	F:A.M.31800	From quarry 5 mi. E. of Yermo, 1932. This paper, <i>Fig. 8</i> .
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REFERRED FROM TYPE LOCALITY, 1932.—

Size of type:

Partial right ramus with p_2 (br.)- m_3 . (w+)	F:A.M.31803
Right maxilla with p^2-m^2 (m^1 br.). (M+)	F:A.M.31791

Moderately smaller size:

Left ramus with p_2 (br.)-
 m_1 . (M-) F:A.M.31799

Partial right maxilla with
 p^2 - m^1 . (M) F:A.M.31793

Immature:

Left fragment, dp_1 - m_1 . F:A.M.31804 This paper, Fig. 3.

(4) *Rakomeryx* species

From Virgin Valley, Nevada

Palæomeryx ? *borealis* (COPE), GIDLEY, 1908, Univ. Cal. Pub. Bull. Dept. Geol., V, p. 241, Figs. 8 and 9.

Dromomeryx sp. *a*, near *borealis* (COPE), MERRIAM, 1911, *ibid.*, VI, p. 280, Figs. 60, 62.

Dromomeryx sp. *b* MERRIAM, 1911, *ibid.*, VI, p. 282, Figs. 61a, b.

EXAMPLE.— m / (broken). U.C.10676 Figured by Gidley, 1908, Figs. 8 and 9.

REFERRED.—

Maxilla with m^1 - m^2 (br.). U.C.11470 Figured by Merriam, 1911, Figs. 61a, b.
(No larger than *S. antilopinus*.)

m_1 . U.C.11748 Figured by Merriam, 1911, Fig. 62.
(Larger-proportioned than U.C.11470.)

Triangular base of horn- U.C.11628 Figured by Merriam, 1911, Fig. 63, under *Dromomeryx*
pedicle. species.

Partial forelimb. U.C.19417 Figured by Merriam, 1911, Figs. 60a, b.

John C. Merriam cites as longer and slenderer than Douglass' Montana specimen. (See *Dromomeryx* skeletal elements, page 180.)

(5) *Rakomeryx gazini*, new species

From Southeastern Oregon

Blastomeryx borealis COPE, referred COPE, 1886, Amer. Nat., XX, p. 368 (lists only).

Dromomeryx, near *borealis* (COPE), GAZIN, 1932, Carn. Inst. Wash. Pub. No. 418, p. 82, Figs. 16, 17.

TYPE.—Partial left horn-pedicle.	C.I.T.351	From Skull Spring, S.E. Oregon. Figured by Gazin, 1932, Fig. 16a.
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REFERRED FROM TYPE LOCALITY.—

Partial right horn-pedicle. (Smaller.)	C.I.T.453	Figured by Gazin, 1932, Fig. 16b.
Maxillary fragment.	C.I.T.449	Figured by Gazin, 1932, Fig. 17a.
Right ramal fragment with p ₃ -m ₁ . (p ₄ anterior fossette formed.)	C.I.T.350	Figured by Gazin, 1932, Fig. 17b.

C. L. Gazin observes that the horn-pedicle is more robust and is markedly curved versus the Montana *Dromomeryx*.

The fragmentary evidence on which *Palaeomeryx*? sp. *a* and *b* is based (listed by Merriam and Sinclair, 1907, and by Gazin, 1932), from the Mascall of Oregon, may represent a very closely allied form or forms.

TENTATIVELY REFERRED FROM COTTONWOOD CREEK (not cited on Table I).—

Partial palate with p ⁴ -m ³ . (M+)	A.M.8204	Cope Collection.
(Approximating in size <i>Dromomeryx whitfordi</i> , ref., F:A.M.31245.)		
Fragmentary left tibia, etc.	A.M.8204X	
(See <i>Dromomeryx</i> skeletal elements, page 180.)		

FIG. 14. *Dromomeryx* Douglass, *Barbouromeryx*, n.g., and *Probarbouromeryx*, n.subg.

× ½. A, A', B, cross sections; MA, auditory meatus; PN, posterior end nasals; PS, posterior border symphysis; 2, supra-orbital foramen.

F:A.M.31500, 31501 (rev.), 31503 (rev.) and P.U.12054, type, of *D. whitfordi* Sinclair, from Sioux County, Nebraska.

(See also Figs. 2, 2A [F:A.M.31500] and pages 118, 117.)

F:A.M.31297, *D. pawniensis*, n.sp., type (B, rev.), from Pawnee Creek, Colorado.
(See page 116.)

A.M.8134 and 8133, rev., and 8132, genotype, of *D. borealis* (Cope), from Montana.

(See pages 115, 114.)

N.S.M.3-27-11-33, *B. trigonocorneus* (Barbour and Schultz), genotype, from Dawes County, Nebraska.

(See also Figs. 2 [cranium], 5, 7, 10 [dentition], 25 [limbs] and page 134.)

N.S.M.53- and 93-25-6-35, *P. sweeti*, n.subg. and sp., subgenotype and ref., from Morrill County, Nebraska.

(See page 135.)

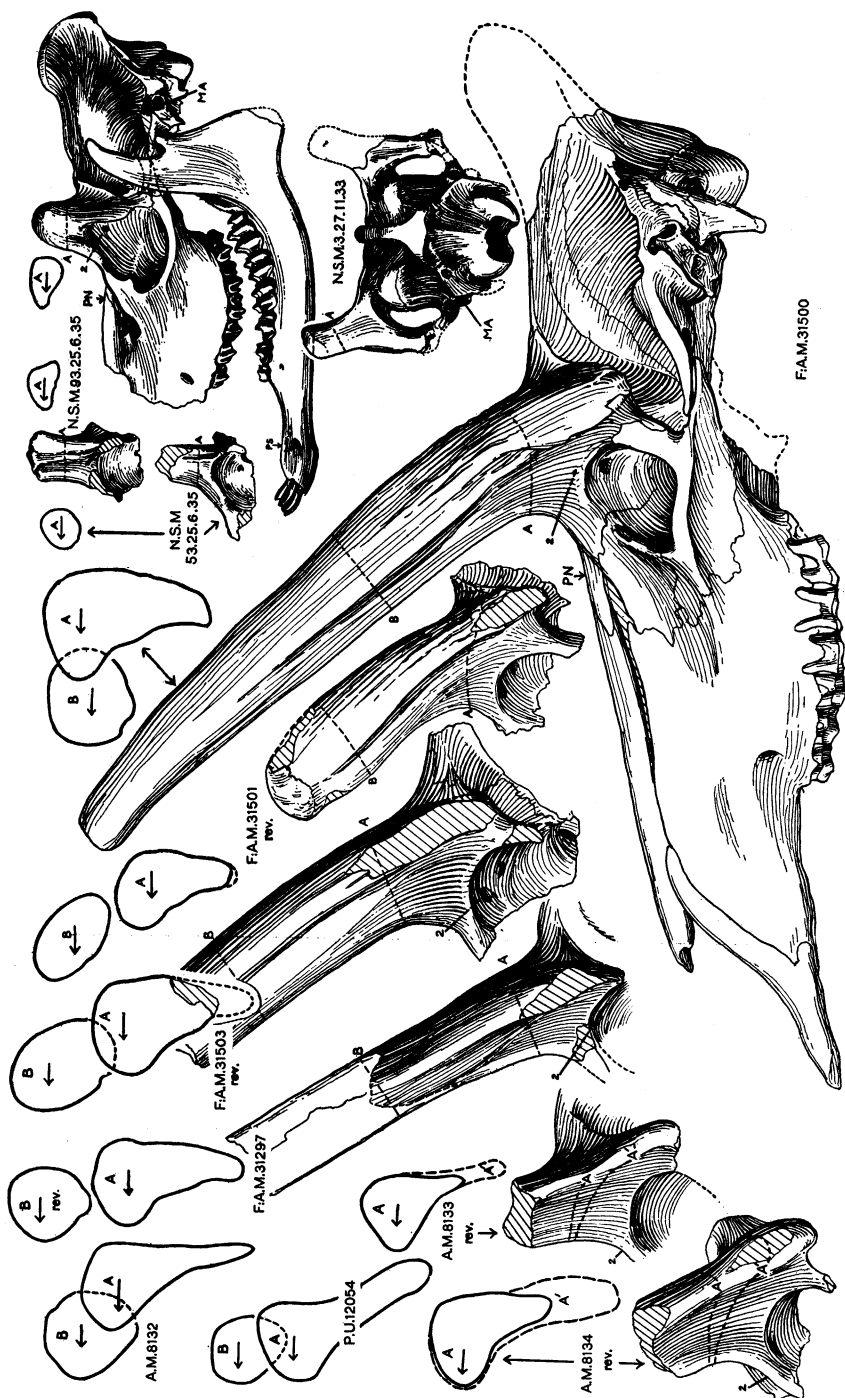


FIG. 14. *Dromomeryx* Douglass (larger), *Barbouromeryx*, n.g., and *Probarbouromeryx*, n.subg. (smaller specimens), from the Tertiary of Nebraska, Colorado and Montana.
 X 1. (See legend, page 107.)

III, **DROMOMERYX** DOUGLASS AND IIIA, **SUBDROMOMERYX**, NEW SUBGENUS

Figures 1c, 14A, 14B and (in part) 2, 2A, 3, 4, 4A, 6, 9, 10, 10A, 14;
Limbs (in part) 17, 18

Statement

The characters of the genus and subgenus, *Dromomeryx* and *Subdromomeryx*, have been cited in the preceding discussion.

Douglass' deer, *Dromomeryx*, genotypic species *D. borealis* (Cope), is based on a partial cranium from Montana. While the genus at times has been thought of in connection with the ancestry of the pronghorn, and the reconstruction of the head (see Figure 1, reconstruction c) superficially is perhaps more suggestive of the pronghorn than of any other living American ruminant, actually both dental and cranial characters are Cervid. Compared to *Antilocapra*, the skull is larger, the orbit and horns are more anteriorly placed, the cranium is proportionately longer through the strangely produced occiput, the teeth, rather than hypsodont, are very notably brachyodont, and the limb elements are heavy Cervid-proportioned.

The characters of the small elk-sized skull are best seen in the superb specimen of an aged individual (Fig. 14), collected by Jack Wilson from Sioux County. The new specimen permits the study of the disposition of bones and sutures not preserved in any heretofore available specimen. The outstanding features are the strong, forwardly directed supra-orbital horn-pedicles, their prominent basal wings, and the orbits lying deep sunk within the latter. The horn-pedicles, which are deeply grooved on the antero-outer face, form an angle of approximately 60° with the plane of the nasals. The position of the orbit and the width of the pedicle flanges must have resulted in the living animal having been extremely susceptible to attack from the rear. The dorsal profile is moderately straight save for swellings over the posterior two-thirds of the nasals and the brain case and the elevation of the backwardly and upwardly produced occiput. A narrow slit-like vacuity parallels the anterior wing of the frontal, and a wide though shallow ant-orbital depression occupies the lacrimal and malar areas. The muzzle is elongate and slightly tapering, the nasal-premaxilla contact wide and the anterior ends of nasals extend well beyond the contact. The specimen is broadest over the protruding flanges of the horn-bases and abruptly constricted posterior to the same. Parietal crests pass back of the horn-pedicles to merge in the sagittal crest, which is carried upward

on the narrow and much produced occiput (see A.M.8132). The posterior horn of *Cranioceras* is very evidently no more than an extreme adaptation of the Dromomerycine occiput. Scott (1895) observes, the "... occiput is utterly unlike that of any existing ruminant and has more the peculiar shape characteristic of *Oreodontidæ*." The basi-cranial axis is moderately bent. The anterior border of the orbits and posterior edge of the palate lie opposite the m^3 . The wide glenoid surface, moderate-sized paroccipital processes, prominent mastoids and constricted auditory bulla and meatus are all preserved and well shown in the specimen. The usual supra-orbital foramina occur at the inner bases of the horn-pedicles, infra-orbital foramina above p^2 and marked parietal foramina anterior to the inion (A.M.8132).

Douglass observes that at least vestiges of portions of the lateral metapodials are retained (these are not now exemplified in the material); that the humerus is proportionately larger than in *Antilocapra*; that the radius and ulna are separate; that the trapezoid-magnum and navicular-cuboid are united; that the distal keels on the metapodials are high; and that the unguals are high and narrow.

The genus, genotypic species *Dromomeryx borealis* (Cope), was described by Douglass in 1909. Previously such remains had been confused with *Blastomeryx* Cope and *Palæomeryx* von Meyer. The genus is well marked in the peculiarly forwardly directed paired horn-pedicles with basal flange, dp_1 retained, moderate premolars relative to molars, and the molariform tendency in both p_4 and p_3 , especially noteworthy in the generally formed p_4 anterior fossette. Among all the here-described Dromomerycini dentitions, that of *Dromomeryx* comes perhaps nearest to that of the modern deer. The premolars tend to be smaller-proportioned; the p_4 anterior fossette is closed (as it tends to be in *Cranioceras*); a similar fossette may be developed in p_3 ; the dp_1 is retained; and the diastema is shorter in contrast with *Cranioceras*.

W. D. Matthew (1918) observes: "*Dromomeryx* is undoubtedly allied by its teeth to the European *Palæomeryx*; its "horns" are of the giraffid type, distinct from the deciduous antlers of cervids and merycodonts and from the true horns of the Bovidæ."

In addition to the three¹ somewhat equal-sized geographic species here recognized from Montana, Colorado and Nebraska, a smaller form, *Subdromomeryx*, is witnessed in remains from Montana and Nebraska. The partial cranium of the type of *S. antilopinus* in the Princeton University collection, described by William B. Scott (1895) and refigured in the present paper (Fig. 14A), exhibits the base of a supra-orbital horn-

¹ Douglass, 1909, p. 477, probably because of Matthew's citation of "*Palæomeryx*" as occurring in New Mexico and Pawnee Creek, Colorado, mistakenly tabulated *Dromomeryx* from both these areas.

pedicle of the same general form but considerably smaller size than the genus proper. An unexpected series of partial skulls of *S. antilopinus* size has been secured in the Sheep Creek beds (fall of 1936) by Jack Wilson. The crania (Fig. 14B) indicate the considerable increase in height of the horn-pedicle in the aged individual, as compared to one which has just attained maturity. Two lower tooth series have the anterior fossette of p_4 closed. (A collection of mandibular rami from the same beds in which the anterior fossette of p_4 is unformed, is for the present held in a separate subgenus, *Bouromeryx*, under which they were described in my original manuscript.) For figures and comparison of limb elements, see page 169.

Summary of Six Dromomerycine Species

Dromomeryx (and *Subdromomeryx*), six species based on specimens showing the horn-pedicles.—

- (1) *Dromomeryx borealis* (Cope), genotypic species, from Montana.

GENOTYPE.—Partial cranium, A.M.8132 (Cope Coll.). This paper, Fig. 14 (horn section).

- (2) *Dromomeryx pawniensis*, n.sp., from Pawnee Creek, Colorado.

TYPE.—Top of cranium, F:A.M.31297. This paper, Fig. 14.

- (3) *Dromomeryx whitfordi* Sinclair, from Sioux County, Nebraska.

TYPE.—Partial left and right horn-pedicles, P.U.12054. This paper, Fig. 14.

- (4) *Subdromomeryx antilopinus* (Scott), from Montana.

TYPE.—Portions of cranium and skeletal elements, P.U.10401. This paper, Figs. 10, 14A, 18.

- (4a) *Subdromomeryx scotti*, n.subg. and sp., from Sioux County, Nebraska.

SUBGENOTYPE.—Partial cranium, F:A.M.33758. This paper, Fig. 14B.

- (4b) *Subdromomeryx wilsoni*, n.sp., from Sioux County, Nebraska.

TYPE.—Partial cranium, F:A.M.33800. This paper, Fig. 14B.

(*Dromomeryx* citation of Douglass (1909), from New Mexico, apparently following Matthew (1909), "*Palæomeryx teres*"—see footnote, page 110; Texas *Dromomeryx* ? *angustidens* Hay, 1924, p. 16, Pl. II, Figs. 6 and 7, possibly a camelid.)

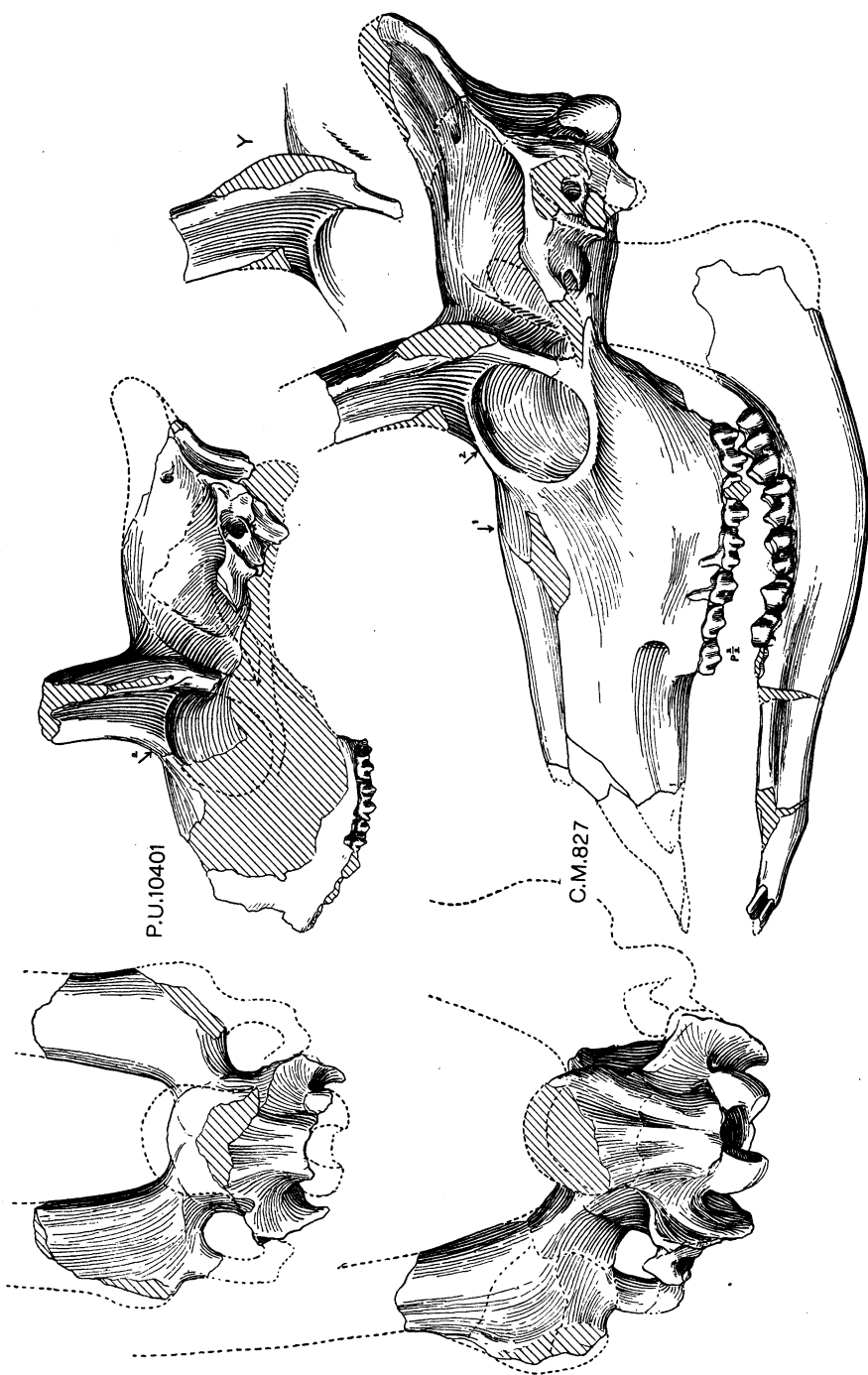


FIG. 14A. *Dromomeryx* Douglass and *Subdromomeryx*, n. subg., from the Late Tertiary of Montana.
 × 1. (See legend, page 114.)

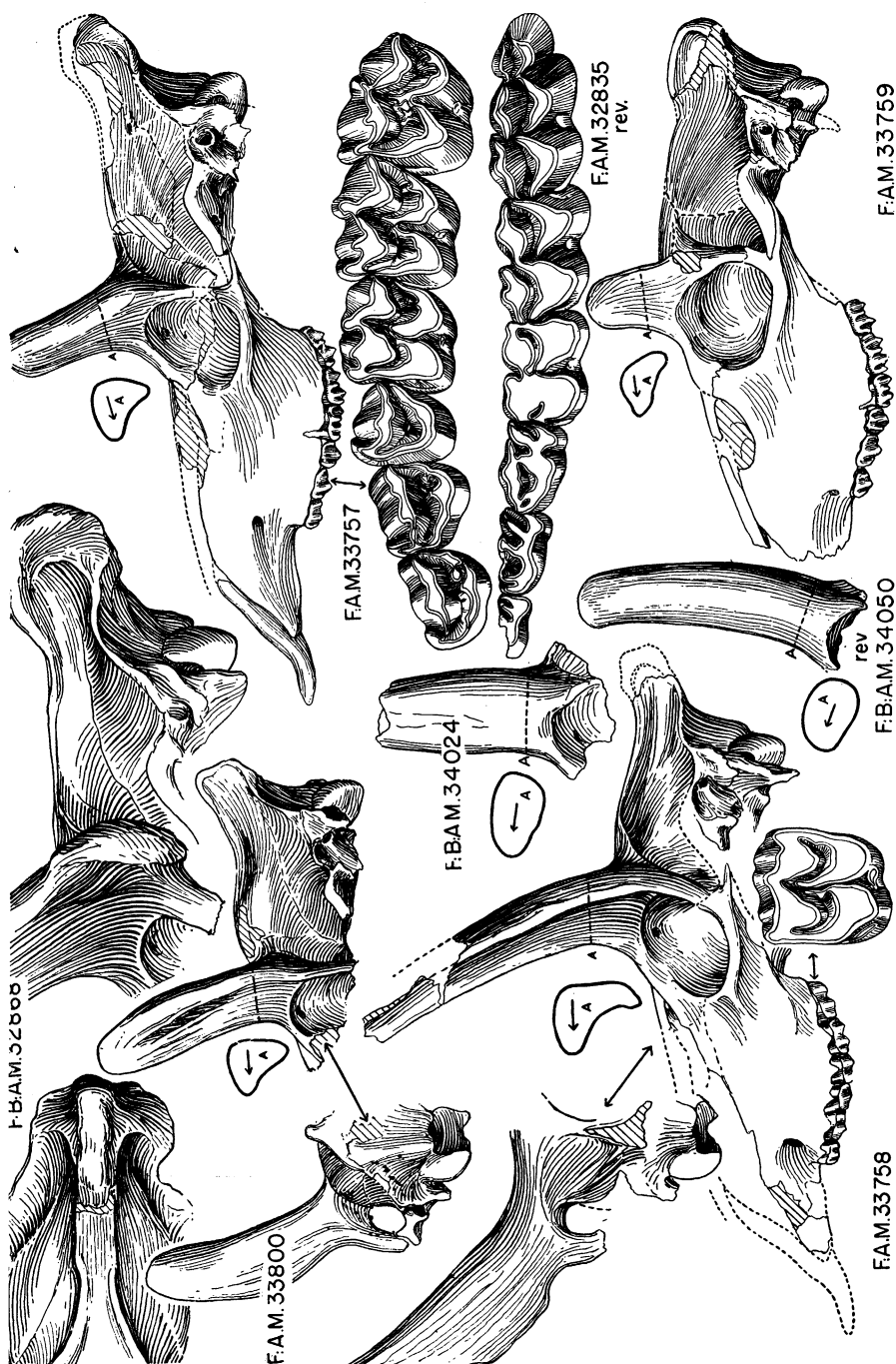


FIG. 14B. *Dromomeryx* Douglass (F.B.A.M. 32868), *Subdromomeryx*, n.subg., and *Bourhomeryx*, n.subg. (F.B.A.M. 34050 and 34024), from the Late Tertiary of Nebraska.
 × † (dentition × 1). (See legend, page 115.)

Detailed Lists of Types, Referred Specimens, and Synonymy

Dromomeryx, total available specimens, 156; numbered and listed, 129; uncatalogued, 27. *Subdromomeryx*, total available specimens, 76; numbered and listed, 74; uncatalogued, 2.

(1) *Dromomeryx borealis* (Cope), genotypic species

From Montana

Blastomeryx borealis COPE, 1878, Proc. Amer. Phil. Soc., XVII, p. 222; Pal. Bull., No. 28, p. 222; Bull. U. S. Geol.-Geog. Surv. Terr., Ser. IV, No. 2, p. 382; Amer. Nat., XII, p. 58 (noted); 1889, *ibid.*, XXIII (March), p. 123, Figs. 16, 19. SCOTT, 1895 (read 1893), Trans. Amer. Phil. Soc., XVIII, p. 168 (and 167).

Palæomeryx borealis (COPE), DOUGLASS, 1903, Ann. Carn. Mus., II, p. 153. MATTHEW, 1904, Bull. Amer. Mus. Nat. Hist., XX, pp. 104, 128, Fig. 21.

Blastomeryx borealis (COPE), MATTHEW, 1908, *ibid.*, XXIV, p. 546.

Palæomeryx borealis (COPE), MATTHEW, 1909, Bull. No. 361, U. S. Geol. Surv., p. 115.

"*Blastomeryx*" *borealis* MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 408 (cited).

Dromomeryx borealis (COPE), DOUGLASS, 1909, Ann. Carn. Mus., V, pp. 457-471, Pls. LIX-LXI; Pl. LXII, Figs. 3, 4; Pl. LXIII, Figs. 1, 3, 6; Text-Figs. 1-3.

GENOTYPE.—Partial cranium with left horn-pedicle and cheek teeth.	Cope Coll. A.M.8132	From Deep River beds, Montana. Figured by Cope, 1889, Figs. 16, 19; by Douglass, 1909, Fig. 1; this paper, Fig. 14 (horn section).
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REFERRED.¹—

Cope Collection specimens:

Cranium with bases of horn-pedicles and cheek teeth.	A.M.8133	This paper, Fig. 14 (horn section).
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¹ Secured by Charles Falkenbach (1936) from E. New Chicago:

		F:A.M.
Partial mandible including p ₂ -m ₂	(w)	34190
Slightly smaller right ramus with p ₄ -m ₄	(w)	34191
(Not included in count.)		

FIG. 14A. *Dromomeryx* Douglass and *Subdromomeryx*, n.subg.

× 1. 1, vacuity; 2, supra-orbital foramen.

C.M.827, *D. borealis* (Cope), ref., from Montana, occiput after A.M.8132. (Y, horn as restored by Douglass, 1909.)

(See also Figs. 9, 10A and page 115.)

P.U.10401, *S. antilopinus* (Scott), type, from Deep River, Montana.

(See also Figs. 10 [dentition], 18 [limbs] and page 123.)

Posterior cranium with base of horn-pedicle. (Largest horn-pedicle.)	A.M.8134	This paper, <i>Fig. 14</i> (horn section).
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Carnegie Museum specimens:

Major portion of skull, ramus, and skeletal elements. (Is best of the here listed specimens.)	C.M.827	Figured by Douglass, 1909, Pl. LIX; Pl. LX, Fig. 3; Pl. LXII, Figs. 3, 4; Pl. LXIII, Fig. 6; this paper, <i>Figs. 9, 10A, 14A.</i>
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Palate, occiput, and skeletal elements.	C.M.1542	Figured by Douglass, 1909, Pl. LX, Figs. 1, 2, 4; Pl. LXIII, Figs. 1, 3; this paper, <i>Fig. 17</i> (limbs).
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(And see *Dromomeryx* limb elements, page 180.)

C. A. Kinsey Collection specimen:

Photographs show a partial skull with nicely preserved dentition from White Cliff, Yellowstone River.

(2) *Dromomeryx pawniensis*, new species

From Pawnee Creek, Colorado

Palæomeryx borealis (COPE), referred MATTHEW, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 128.

Dromomeryx DOUGLASS, 1909, Ann. Carn. Mus., V, p. 477 (table).

Dromomeryx borealis (COPE), MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 72 (cited).

FIG. 14B. *Dromomeryx* Douglass, *Subdromomeryx*, n.subg., and *Bouromeryx*, n.subg.

× $\frac{1}{2}$ (dentition × 1). A, cross section.

F:B:A.M.32868, *D. whitfordi*, var., from Dawes County, Nebraska.

(See page 122.)

F:A.M.33758 (subgenotype), 33757, 33759 (adolescent) and 32835, *S. scotti*, n.subg. and sp., from Sioux County, Nebraska.

(See pages 123, 124.)

F:A.M.33800, *S. wilsoni*, n.sp., type, from Sioux County, Nebraska.

(See page 126.)

F:B:A.M.34050 (rev.) and 34024, (?) *Bouromeryx pseudonebrascensis*, n.sp., ref., from Dawes County, Nebraska.

(See page 132.)

TYPE.—Top of cranium with partial horn-pedicles.	F:A.M.31297	From near Pawnee Buttes. Collected by the John C. Blick party, 1931. This paper, <i>Fig. 14.</i>
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REFERRED, COLLECTED BY THE JOHN C. BLICK PARTY.—

Base of left horn-pedicle.	F:A.M.31298	1931.
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Twelve partial rami of moderate and less moderate-sized individuals. (The form of the p_4 is shown best in slightly worn F:A.M.31302 and 31301 and unworn F:A.M.31306.)

Moderate-sized:

Partial right ramus with p_2 - m_3 . (M)	F:A.M.31306	From Horse Quarry, 1932. This paper, <i>Figs. 6</i> (m_3), <i>9</i> .
Right fragment with p_2 alveolus, p_3 - m_3 . (M+)	F:A.M.31301**	From east of camp, 1932.
Partial right ramus with p_2 - m_3 (br.). (w)	F:A.M.31303	From Section 8, 1931.
Right fragment with m_2 (br.)- m_3 . (M+)	F:A.M.31308	1932.
Right fragment with p_4 - m_3 (m_1 br.). (M)	F:A.M.31302	1931.
Left fragment with m_1 - m_3 . (w++)	F:A.M.31300	From Section 8, 1931.
Right fragment with m_1 - m_3 . (M+)	F:A.M.31305	1933.
Right fragment with m_2 (br.)- m_3 . (w)	F:A.M.31310	From Section 8, 1931.

Smaller-sized:

Left ramus with symphysis, /I.roots, p_2 - m_3 . (M+)	F:A.M.31299**	From Section 8, 1931. This paper, <i>Fig. 6.</i>
Right fragment with p_2 (br.)- m_3 . (w)	F:A.M.31304	From Mastodon Quarry, 1931.
Right fragments with p_3 - p_4 , m_2 - m_3 . (M+)	F:A.M.31307	From Lower Mastodon Quarry, 1932.
Right fragment with p_2 alveolus and p_3 - m_1 . (M)	F:A.M.31309	From Section 8, 1931.

**See page 117, footnote.

Maxillary fragments:

Right m^1 - m^2 .	F:A.M.31311
Right m^1 , m^2 and left m^3 .	F:A.M.31317C, A and B

Two rami of the American Museum Expedition, 1901:

Right ramus with diastema and p_1 - m_3 . (w++)	A.M.9450
Partial right ramus with p_2 (br.)- m_3 . (w+)	A.M.9451

See Limb Section, page 181.

(3) *Dromomeryx whitfordi* Sinclair

From Sioux County, Nebraska

Palæomeryx sp. MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 408, Figs. 21, 22.

Dromomeryx whitfordi SINCLAIR, 1915, Proc. Amer. Phil. Soc., LIV, p. 94, Figs. 17, 18. MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 193.

Dromomeryx borealis (COPE), MATTHEW, 1924, *ibid.*, p. 72 (cited as also present).

TYPE.—Partial left and right horn-pedicles.	P.U.12054 Loc. 1000C	Figured by Sinclair, 1915, Fig. 17; this paper, Fig. 14.
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Since the editing of the present pages, a beautifully preserved skull (Fig. 14), a cranial saddle with portions of both horn-cores and orbits, and several mandibular rami have been secured from the Echo Quarry of Sioux County by Jack Wilson. The skull has been described on a preceding page. The rami include individuals of moderate to largest size. One of the new rami is remarkable in exhibiting an abnormal m_3 with double-columned heel (Fig. 9). The p_2 anterior fossette is less formed than usual, and in one specimen (F:A.M.31506) the p_1 anterior fossette is open. The posterior half of a skull with orbital horn-cores, and other remains collected in Dawes County by Ted Galusha, indicate the presence of this or a closely allied species.

Referred remains in the American Museum and Princeton Museum collections from the vicinity of the type locality, Sinclair Draw, Snake

¹ For tendency to formed anterior fossette in p_2 see specimens starred (**) in detailed lists: Sioux County, pages 118, 119, 120; Dawes County, page 122; and Pawnee Creek, page 116.

Creek area, represent three size variants: (a) largest-sized teeth, typified by the well-preserved specimens, A.M.22386 and 18873; (b) intermediate, exemplified by P.U.12086; and (c) moderate-sized, exemplified by (F:A.M.31226 and) A.M.18872A. The last approximate the average of the Pawnee Creek remains. In the Sinclair paratype right ramus, P.U.12086, Sinclair's (1915) figure 18, the p_2 is slenderer and the p_4 anterior fossette less formed than the average.

REFERRED REMAINS COLLECTED FROM ECHO QUARRY BY JACK WILSON, 1934-35.—

Skull, left side beautifully preserved, right side less well preserved and horn-pedicle broken, occiput damaged. (w++)	F:A.M.31500	This paper, <i>Figs. 2, 2A, 14.</i>
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B.L.....	= 353 mm.	
Much worn p^2-m^3	= 95	versus
Moderately worn F:A.M.31198	= 100	

The specimen, characterized on a preceding page, for the first time shows the form of the facial vacuity, orbital depression, bullæ, etc.

Cranial saddle.	F:A.M.31503	This paper, <i>Fig. 14.</i>
Frontlet and horn-core.	F:A.M.31501	This paper, <i>Fig. 14.</i>
Left adolescent horn-pedicle.	F:A.M.31502	

(a) Large to largest:

Left fragment, p_2-m_3 . (M+)	F:A.M.31505	
Right ramus, p_2-m_3 . (M+)	F:A.M.31506	
Left ramus, p_2-m_3 . (w+)	F:A.M.31507	
Immature left ramus with diastema and dp_1-m_3 (un-erupted).	F:A.M.31508	This paper, <i>Fig. 3.</i>
Left ramus with symphysis and p_2-m_3 (note peculiar m_3 heel with fourth crest).	F:A.M.31509**	This paper, <i>Figs. 4, 4A, 9.</i>
Right ramus with p_2 alveolus and p_3-m_3 . (M+)	F:A.M.31194**	
Left ramus with p_3-m_3 (br.). (M)	F:A.M.31195	

**See page 117, footnote.

Left ramus with p_2 alveolus and p_3-m_3 . (w) F:A.M.31196

Right maxilla, p^2-m^3 . (M+) F:A.M.31198

(c) Moderate-sized:

Left ramus, symphysis, /Is alveoli, p_2-m_3 (br.). (w) F:A.M.31504

Left ramus with symphysis and p_2-m_2 . (w+) F:A.M.31197

REFERRED, PREVIOUSLY COLLECTED FROM THE GENERAL AREA.—

TWENTY-EIGHT RAMI

(a) Largest:

Right ramus with diastema, p_2-m_3 (br.). (M+) A.M.22386** From Sinclair Draw, Ashbrook Pasture, 1927. This paper, *Fig. 6*.

Right ramus with symphysis, dp_1 alveolus and p_2-m_3 . (w) A.M.18873** From Quarry A, Sinclair Draw, 1921.

Partial left ramus with p_4-m_3 . (M+) F:A.M.31243 From W. Sinclair Draw, 1933.

(b) Intermediate-sized:

Partial left ramus with p_3-m_3 . (M+) F:A.M.31228 From W. Sinclair Draw, 1933. This paper, *Figs. 6, 9*.
(m_3 smaller than in other specimens.)

Partial right ramus with p_2-m_3 . (M+) P.U.12086 From Snake Creek beds, 1914. Figured by Sinclair, 1915, *Fig. 18* (as paratype).

Partial right ramus with p_3 (br.)- m_3 . (w+) F:A.M.31227 From W. Sinclair Draw, 1933.

Partial left ramus with p_2-m_2 . (w) F:A.M.31229 From E. Sinclair Draw, 1933.

Right fragment with p_3-m_2 . (M) A.M.17331 From Snake Creek area, 1916.

Left fragment, p_4-m_3 . (M+) F:A.M.31230 From W. Sinclair Draw, 1932.

Right fragment with p_4-m_3 . (M+) F:A.M.31235 From E. Sinclair Draw, 1933.

Right fragment with p_4 - m_3 . (w)	F:A.M.31234	From E. Sinclair Draw, 1933.
Left fragment, p_4 - m_3 . (M+)	A.M.17334	From Snake Creek area, 1916.
Left fragment with p_2 alveolus and p_3 - m_3 . (w)	A.M.17332	From Snake Creek area, 1916.
Left fragment with p_3 - m_1 (br.) and m_3 . (M+)	A.M.22362**	From Ashbrook Pasture, 1927.
Right fragment with p_2 - m_1 . (M)	F:A.M.31233	From E. Sinclair Draw, 1933.
Right fragment with m_1 - m_3 . (M+)	F:A.M.31244	From W. Sinclair Draw, 1932.
Left fragment, p_3 - m_1 . (w)	F:A.M.31232	From E. Sinclair Draw, 1933.
Left fragment with m_1 - m_3 . (w+)	A.M.17335	From Snake Creek area, 1916.
Left fragment with p_3 - m_2 (br.). (M+)	A.M.14123	From Snake Creek area, 1908. Figured by Matthew and Cook, 1909, Fig. 21.
Left fragment, p_4 - m_3 . (M+)	F:A.M.31231	From W. Sinclair Draw, 1933.
Left fragment with m_2 - m_3 . (M+)	F:A.M.31225	From Sinclair Draw, 1933.
Right fragment with m_2 - m_3 . (M+)	F:A.M.31236	1932.
Right fragment with m_2 - m_3 . (M+)	F:A.M.31237	From E. Sinclair Draw, 1933.
Left fragment with m_2 - m_3 . (w+)	A.M.14124	From Snake Creek area, 1908. Figured by Matthew and Cook, 1909, Fig. 22.
Right fragment with m_1 - m_3 . (M)	A.M.14125	From Snake Creek area, 1908.

(c) Moderate-sized, slender (reference questioned):

Left ramus with symphysis, p_2 alveolus, p_3 - m_2 . (M+)	F:A.M.31226	From E. Sinclair Draw, 1933.
Left fragment with p_3 - m_3 (br.). (M+)	A.M.18876**	From Quarry B, Sinclair Draw, 1921.
(/ms small. Best examples of smaller.)		
Left fragment with p_2 - m_3 . (M+)	A.M.18872A**	From Quarry A or B, Sinclair Draw, 1921.

EIGHT IMMATURE RAMI

Left ramus with symphysis, dp_1 alveolus, dp_2 - m_2 (erupting) and germs.	A.M.18875	From Quarry A or B, Sinclair Draw, 1921. This paper, <i>Fig. 3</i> .
Left ramal fragment with dp_2 - m_1 and germs (dp_2 - dp_3 br.).	F:A.M.31239	From Sinclair Quarry, 1932.
Left ramal fragment with dp_1 - dp_2 alveoli, dp_3 - m_1 and germs.	F:A.M.31240	From E. Sinclair Draw, 1933.
Right dp_1 alveolus and dp_2 - m_1 .	F:A.M.31241	From E. Sinclair Draw, 1933.
Right dp_3 - m_1 .	F:A.M.31242	From Quarry No. 1, 1932.
Left dp_1 alveolus- dp_3 .	F:A.M.31202	From Sinclair Draw, 1933.
Left dp_4 - m_1 and alveoli.	A.M.17336	From Snake Creek area, 1916.
Left dp_3 - m_1 .	A.M.17333	From Snake Creek area, 1916.

THREE MAXILLÆ

Right maxilla with p^2 - m^2 . (M)	F:A.M.31245	From Sinclair Quarry, 1932. This paper, <i>Fig. 10A</i> .
Right maxilla, p^4 - m^2 . (A)	A.M.18874	From Sinclair Draw, 1921.
Right m^2 - m^3 . (M)	A.M.14124A	From Snake Creek area, 1908.

Also (a) two premolars and fourteen somewhat larger detached molars, and (b) four premolars and seven more moderate-sized detached molars.

REFERRED LIMB ELEMENTS (see Limb Section, pages 181, 182).—

EXAMPLED.—

Larger size:

Right metatarsus, 235 mm.	F:A.M.31881	From E. Sinclair Draw, 1933. This paper, <i>Fig. 17</i> .
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Note right metacarpus, F:A.M.31873 (this paper, *Fig. 18*), from E. Sinclair Draw, listed under *Cranioceras*, possibly may represent a small-sized individual of *Dromomeryx*. (See page 176.)

Dromomeryx whitfordi, Var.

From Observation Quarry, Dawes County, Nebraska

Collected by Ted Galusha, 1936

EXAMPLE.—Posterior half of cranium with right horn-core intact, and produced and elevated occipital crest..... *Fig. 14B* F:B:A.M. 32868

REFERRED.—

Cranial saddle with both horn-pedicles, basal flanges indicating larger individual than above. [From Lone Tree Prospect.]..... 34040

ELEVEN MANDIBULAR RAMI

Mandible with symphysis and p_2-m_3	** (w+)	33754
Left ramus with symphysis and p_2-m_3	(m++)	34020
Left ramus with diastema and p_2-m_3	(m)	33777
Left ramus with symphysis and p_2-m_3	** (w)	33750
Left ramus with symphysis and p_2-m_2	(w)	33752
Left ramus with symphysis and p_2-m_3	(w++)	33755
Right ramus with p_2-m_3	** (w)	34020A
Right symphysis and p_2-m_1	(w+)	33770A

Three immature rami:

Left immature ramus with diastema and dp_2-m_1 . (Questioned.).....		33771
Left ramus with diastema and dp_2-m_2		33778
Right ramus with diastema, dp_2 and dp_4 (br.)- m_2		33778A

TWO MAXILLARY SPECIMENS

Left p^3-m^3	(w)	33753
Right p^2-m^1	(w)	34021

TENTATIVELY REFERRED (smaller-toothed).—**THREE IMMATURE RAMI**

Left ramus with diastema and p_1-m_2		34041
Right fragment with p_1 alveolus, dp_2-m_1		34042
Left ramus with p_1 alveolus, dp_2 , dp_4 - m_2 (br.).....		34043

Referred limbs, page 182.

QUESTIONABLY REFERRED FROM GILMORE QUARRY, DAWES COUNTY, COLLECTED BY TED GALUSHA, 1935.—

		F:B:A.M.
Right p_4-m_1	(m+)	32879
Right m_1 (br.)- m_3	(w+)	32879A
		N.S.M.
Fragment with right m^2-m^3	(w)	1-20-7-35

**See page 117, footnote.

(4) **Subdromomeryx antilopinus** (Scott)

From Deep River, Montana

Blastomeryx antilopinus SCOTT, 1893, Amer. Nat., XXVII, p. 662; 1895 (read 1893), Trans. Amer. Phil. Soc., XVIII, p. 168, Pl. VI, Figs. 48–51. DOUGLASS, 1909, Ann. Carn. Mus., V, p. 457 (only mentioned).

Dromomeryx antilopina SCOTT, 1913, A History of Land Mammals in the Western Hemisphere, p. 237, Fig. 128.

TYPE.—Portions of cranium bearing horn-pedicle, broken p^2 – p^4 and m^1 – m^3 ; also partial elements of both fore and hind limbs and feet, considered as of same individual (see details under skeletal elements, page 182).	P.U.10401	Figured by Scott, 1895, Pl. VI, Fig. 48 (cranium); Figs. 49, 51 (limb elements); this paper, Figs. 10 (dentition), 14A (skull), 18 (left radius and right metacarpus).
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m^1 – m^3 = 44 mm. (and approximating ?*B. americanus*, ref., C.M.706).

REFERRED¹ FROM DEEP RIVER.—

Right p^2 – m^3 . (M+)	A.M.8134A	Cope Collection.
Anteroposterior length p^2 – m^3 = 43 mm. (Teeth small, broken; specimen formerly placed with <i>D. borealis</i> and never before prepared.)		
Right fragment with p_4 . (p_4 fossette closed.)	A.M.21311	From 7 miles S.E. of Fort Logan, 1925.

(4a) **Subdromomeryx scotti**, new subgenus and species

From Greenside Quarry, Sioux County, Nebraska, 1936

SUBGENOTYPE.—Skull (nasals and premaxilla missing) with complete dentition and portions of both horn-pedicles. (w)	F:A.M.33758	This paper, Fig. 14B.
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REFERRED.—

Skull, including left premaxilla, horn-pedicles and complete dentition. (M+)	F:A.M.33757	This paper, Fig. 14B.
(Adolescent individual, horn-pedicles short.)		

¹ Secured by Charles Falkenbach (1936) from E. New Chicago: F:A.M. 34192
Right fragmental ramus with m_1 – m_2 (w)
(The above specimen not included in the general count of specimens.)

- Posterior two-thirds of skull with left horn-pedicle and p^2-m^2 . (M) F:A.M.33759 This paper, Fig. 14B.
(m^3 erupting but unworn, horn-pedicle notably smaller than in above specimen. Horn very suggestive of *Barbouromeryx trigonocorneus*.)
- Right mandibular ramus with p_2-m_3 . (M+) F:A.M.32835 This paper, Fig. 14B.
(p_4 anterior fossette closed.)

TENTATIVELY REFERRED (SLENDERER-TOOTHED).—

A series of mandibular rami from the Greenside Quarry (type locality), and from Thomson Quarry, that differ from the one above-listed ramus in the open character of the p s, and that are distinguished from the specimens grouped below under *Bouromeryx* by their notably slender and less brachyodont molars, are very tentatively held as a separate section under this subgenus. The proportionately large and unreduced premolars and subhypsodont-tending molars are suggestive of a stage intermediate to the Sioux County (Thomson Quarry) *Sinclairiomeryx* and the more typical of the Sioux County *Bouromeryx*. The specimens are divided between subgroups (a) diastema short, premolars moderate and (b) diastema longer, premolars somewhat reduced.

(a) Diastema short, premolars moderate:

From Greenside Quarry:			F:A.M.
Right ramus with symphysis and p_2-m_3	(M+)	32487	
	Figs. 4, 4A		
Right ramus with symphysis and alveoli, p_2-m_3	(W+)	32494	
Right fragment with symphysis and p_2-m_3	(W)	32498A	
Left ramus with symphysis and p_4-m_3	(W)	32493	
Right ramus with symphysis and p_2 (br.)- m_3	(W++)	32497	
Right fragment with p_2-m_3	(W)	32496A	
Right fragment with p_2 and m_1-m_3	(A)	32497A	
Right fragment with p_4-m_3 (br.).....	(M++)	32490A	

From Thomson Quarry:

Right ramus with symphysis and p_2-m_3	(M)	31212
	Figs. 5, 7	

Length of tooth series approximating *Bouromeryx milleri*; the tooth series being of nearly the same length but the teeth somewhat slenderer, the /ps proportionately larger, the /ms smaller and the diastema still shorter than in A.M.21533.

Right ramus with p_2 (br.)- m_3	(M+)	31218
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Right ramus with $p_2(\text{br.})-m_3$	(w++)	A.M. 21539
Right fragment with $m_1-m_3(\text{br.})$	(w+)	F:A.M. 31573

(b) Diastema longer, premolars somewhat reduced:

From Greenside Quarry:

Right ramus with symphysis and p_2-m_3	(M++)	32488
Left ramus with symphysis and p_2-m_3	(M++)	32492
Left ramus with symphysis and p_2-m_3	(w)	33796
Right ramus with symphysis and p_4-m_3 (m_2 br.).....	(w+)	32496
Right ramus with symphysis and p_2-m_3 (p_2 and p_4 br.)..	(w)	32495
Right fragment with p_4-m_3 (p_4 br.).....	(w)	32498

Five immature rami:

Immature left ramus with diastema and dp_2-m_1	<i>Fig. 3</i>	32491
Immature left ramus with diastema and dp_2-m_1		32489
Right ramus with diastema, p_1 alveolus and dp_2-m_3 (erupting).....		33797
Right ramus with diastema, p_1 alveolus and dp_2-m_1		33799
Right ramus with diastema and dp_2-m_1 (no sign of p_1 alveolus).....		33798

Questionably referred (with larger m_3):

Right ramus with symphysis and p_2-m_3	(M)	32490
Left m_1-m_3	(w)	32834
Left fragment with m_3	(M)	32498B

A fragmental mandibular specimen, with teeth of the general size of F:A.M. 31212, is worthy of particular notice. The specimen (F:A.M.32499), from Greenside Quarry, is remarkable in the retention of what seems to be a p_1 . The tooth is diminutive and is only slightly separated from the p_2 .

Left ramus with (?) p_1 and p_2-m_3	(w++)	32499
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Doubtful. From Long Quarry [probably distinct species (4aa)]:

Length of diastema unknown, teeth tending smaller and slenderer-crowned:

Left p_2-m_3	(w)	32483
Left p_2 alveolus and p_2-m_3	(M)	32484
Right p_4-m_3	(M)	32485

		F:A.M.
Left p_3-m_1	(M)	32485A
Left m_1-m_3	(M+)	32485B
Right p_4-m_3	(W+)	32485C
Left fragment with m_3	(W+)	31574
Two fragments.		

(Compare mandibular dentitions under *Bouromeryx milleri*, from Sioux County, page 130.)

(4b) **Subdromomeryx wilsoni**, new species

From Thomson Quarry, Sioux County, Nebraska

TYPE.—Posterior one-half of skull with both horn-pedicles. F:A.M.33800 1936. This paper, *Fig. 14B*.

(The small size of the cranium and the anteroposterior and transverse slenderness of the horn-pedicle bases contrast with the remains described above under *S. scotti*.)

REFERRED.—

From Thomson Quarry, 1934 and 1936:

		F:A.M.
Left mandibular ramus with p_2 base- m_3 (p_4 closed).....	(M+)	32500
Left ramus with p_2-m_3 (p_4 open).....	(W+)	32888
Three maxillæ:		
Right maxilla with p^3-m^3	(M)	32889
Right maxilla with p^2-m^3	(W+)	32889A
Left maxilla with p^4-m^3	(W)	32889B

Doubtful. From Long Quarry, 1935 [probably distinct species (4bb)]:

Right m_2-m_3	(M)	32897
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Subfamily 3.—**Barbouromerycinæ**IV. **BOUROMERYX**, NEW SUBGENUSV. **BARBOUROMERYX**, NEW GENUSVA. **PROBARBOUROMERYX**, NEW SUBGENUSVB. **PROTOBARBOUROMERYX**, NEW SUBGENUS

Figures (in part) 2, 3, 4, 4A, 5, 7, 10, 14; Limbs (in part) 25

Statement

The Late Tertiary *Bouromeryx*, n.subg., and Middle Tertiary *Barbouromeryx*, n.g., *Probarbouromeryx*, n.subg., and *Protobarbouromeryx*, n.subg., have been mentioned in the introductory discussion, page 49.

Bouromeryx, n.subg., is allowed to embrace a large and varied series of mandibular dentitions characterized by short-crowned molars, open p_4 and (where observable) short-tending diastema (page 130). While the range of individual and sexual variation is unknown, a number of distinct species are evidently involved. For convenience the remains are divided between "superspecies" ("S" 1-3) embracing six species and subspecies:

"S"-1. Species (1), (1b), (2) and (3), moderate-sized, from Sioux County, Nebraska, Montana and Colorado; and (1a), small-sized, from Sioux County, Nebraska. Species (1) and (1a), from the Sheep Creek zone, tend to exhibit relatively large-proportioned premolars.

"S"-2. Species (1c), large-sized, from Dawes County (Observation Quarry), Nebraska, differs from the preceding species in its notably larger size and shorter-proportioned diastema.

"S"-3. Species (1d), moderate-sized, from Dawes County (Observation Quarry), Nebraska, with longer-proportioned diastema. The specimens, save for their smaller size, tend to recall *Procranioceras*.

Orbital horn-cores [F:B:A.M.34050 from Dawes County (Observation Quarry)] are more like *Cranioceras* than *Dromomeryx* in the external base lacking the indentation and outward flare characteristic of the latter. It is believed that the Dawes specimens pertain to the *Bouromeryx* species of the mandibular rami. The subgenus, perhaps, might be referred better to the *Craniocerotinae* than to the *Barbouromerycinae*.

Barbouromeryx is well seen in the genotypic species, *B. trigonocorneus* (Barbour and Schultz), from the vicinity of Antelope Creek, Dawes County, Nebraska. The type, excepting for small size and relatively

short and strongly bulbous-tipped horn-pedicles with bare suggestion of postorbital flanges, recalls *Dromomeryx* proper. Its most striking characters—the production of the occiput and elevation of the sagittal crest, the anteriorly set orbit, the brachyodont and unreduced premolars and the heavy-proportioned limbs—as observed by Barbour and Schultz, are *Dromomerycine*. The metapodials are barely as long as in *Parablastomeryx gregorii*. An enlarged upper canine, found in apparent association with the type specimen, points to the males of the genus being armed with sabre-like canines, as in *Aletomeryx* and *Blastomeryx*. *Barbouromeryx* seems to differ from *Dromomeryx* in size, canines, open p_4 and less elongate horn-pedicles. This brachyodont genus is definitely more conservative than contemporary *Aletomeryx*. The unique type specimen differs from *Aletomeryx* in the slightly larger size, more prominent sagittal crest, more produced occiput, heavier and shorter horn-pedicles, notably more brachyodont molars and unreduced premolars. The teeth are practically unworn; with age it is highly probable that, as in *Aletomeryx*, the height of the horn-pedicles would somewhat increase. There is a large suborbital vacuity, the glenoid is broad and the bullæ moderate. *Probarbouromeryx* and *Protobarbouro-*
meryx are erected for small forms from the Middle Tertiary. In the last the premolars are proportionately reduced. This reduction of the premolars, were it not for the lowness of the tooth crowns, would suggest that the species occupied middle ground between *Barbouromeryx* and *Aletomeryx*.

Summary of Barbouromerycine Species

LATE TERTIARY (large to moderate size).

- (1) *Bouromeryx milleri*, n.subg. and sp., from Sioux County, Nebraska.

SUBGENOTYPE.—Mandible, A.M.21533. This paper, *Figs. 5, 7*.

- (1a) *Bouromeryx submilleri*, n.sp., from Sioux County, Nebraska.

TYPE.—Right ramus, F:A.M.33729.

- (1aa) (?) *Bouromeryx parvus* (Cook), from Sioux County, Nebraska.

TYPE.—Partial left ramus, H.C.295.

- (1b) *Bouromeryx nebrascensis*, n.sp., from Echo Quarry, Sioux County, Nebraska.

TYPE.—Right ramus, F:A.M.31193.

- (1c) *Bouromeryx supernebrascensis*, n.sp., from Dawes County, Nebraska.

TYPE.—Right ramus, F:B:A.M.33733.

- (1d) (?) *Bouromeryx pseudonebrascensis*, n.sp., from Dawes County, Nebraska.

TYPE.—Left ramus, F:B:A.M.33735.

- (2) (?) *Bouromeryx americanus* (Douglass), from Montana.

TYPE.—Left ramus, C.M.705.

- (2a) *Bouromeryx madisonius* (Douglass), from Montana.

TYPE.—Ramal fragment, C.M.755. (Possibly *Cranioceras*.)

- (3) *Bouromeryx pawniensis*, n.sp., from Pawnee Creek, Colorado.

TYPE.—Partial right ramus, F:A.M.31290. This paper, *Fig. 7*.

MIDDLE TERTIARY (smaller size.)

- (4) *Barbouromeryx trigonocorneus* (Barbour and Schultz), genotypic species, from Antelope Creek, Dawes County, Nebraska.

GENOTYPE.—Partial skull, both rami, and skeletal elements, N.S.M. 3-27-11-33. This paper, *Figs. 2, 5, 7, 10, 14, 25*.

- (5) *Probarbouromeryx sweeti*, n.subg. and sp., from Bridgeport, Morrill County, Nebraska.

SUBGENOTYPE.—Right and left frontlets with portions of horn-pedicles, N.S.M.53-25-6-35. This paper, *Fig. 14*.

- (6) *Protobarbouromeryx marslandensis*, n.subg. and sp., from Box Butte County, Nebraska. (Premolars somewhat reduced.)

SUBGENOTYPE.—Left ramus, N.S.M.3-24-7-34. This paper, *Figs. 4, 4A*.

Detailed Lists of Types, Referred Specimens, and Synonymy

IV, **BOUROMERYX**, NEW SUBGENUS, V, **BARBOUROMERYX**, NEW GENUS, VA, **PROBARBOUROMERYX**, NEW SUBGENUS, AND VB, **PROTOBARBOUROMERYX**, NEW SUBGENUS

Bouromeryx, total available specimens, 66. *Barbouromeryx*, total available listed specimens, 11. *Probarbouromeryx*, total available specimens, 77; numbered and listed, 62; uncatalogued, 15. *Protobarbouromeryx*, total available listed specimens, 2.

(See preceding statement of characters.)

(1) **Bouromeryx milleri**, new subgenus and species

From Sioux County, Nebraska

SUBGENOTYPE.—Well pre-served mandible with symphysis and p_2 - m_3 of both sides. (M+) A.M.21533 Collected by Paul C. Miller, 1925, from "Sheep Creek," *Aphelops* Draw. This paper, *Figs. 5, 7.*

COMPARISON OF MEASUREMENTS	(?) <i>Subdromomeryx scotti</i> F:A.M.31212	<i>B. parvus</i> H.C.295 (according to Cook)	<i>B. milleri</i> A.M.21533
Post. edge symphysis—post. edge m_3 ...	104 mm.	111 mm.	115 mm.
Ant. edge p_2 alveolus—post. edge m_3 ...	77.5	75	80
p_4 - m_3	58	56	61.5
p_4	12.5	11	12.2
m_3	20	20	21.5
Depth ramus below p_4	20	24	20.4

QUESTIONABLY REFERRED FROM SIOUX COUNTY LOCALITIES.—			F:A.M.
Left fragment with p_4 - m_3	(M)	1933	31207
Right fragment with p_3 - p_4	(W)		31208
Right fragment with symphysis and p_2 (br.)- p_4	(W)	1933	31210
			A.M.
Right ramus with symphysis, dp_1 alveolus, dp_2 - dp_4 .		1923	20531
Left dp_3 - m_1		1922	18958
			F:A.M.
Right maxilla with m^1 - m^3 and p^4 root.....	(M+)	1933	31209

(Limb elements may possibly be represented in the series listed under *Subdromomeryx scotti*, page 183.)

(1a) **Bouromeryx submilleri**, new species

From Greenside Quarry, Sioux County, Nebraska

(Size small)

TYPE.—Right ramus with p_2 - m_3 . (Size of *Subdromomeryx wilsoni*, F:A.M.32500, and *Sinclairiomeryx riparius*, var., F:A.M.32469). (M) F:A.M. 33729

(1aa) (?)**Bouromeryx parvus** (Cook)

From Sioux County, Nebraska

Dromomeryx parvus COOK, 1922, Proc. Col. Mus. Nat. Hist., IV, No. 2, p. 13, figured p. 21.

TYPE.—Left partial ramus H.C.295 From Snake Creek beds, 1914.
with p_4 - m_3 . Figured by Cook, 1922, p. 21.

(1b) **Bouromeryx nebrascensis**, new species

From Echo Quarry, Sioux County, Nebraska

TYPE.—Right ramus with p_2 - p_3 alveoli and p_4 - m_3 (w) 1935 F:A.M. 31193

REFERRED.—

Immature left ramus with dp_1 - m_2 and p_4 germ..... Fig. 3 1934 31199

(1c) **Bouromeryx supernebrascensis**, new species

From Observation Quarry, Dawes County, Nebraska, 1936

TYPE.—Right ramus with diastema and p_2 - m_3 (M) F:B:A.M. 33733

REFERRED.—

Right ramus with diastema and p_2 - m_3 (w) 33734
Left ramus with diastema and dp_2 - m_1 34007A
Partial right maxilla with p^2 - m^1 (w) 34008A

(1d) (?)*Bouromeryx pseudonebrascensis*, new species

From Observation Quarry, Dawes County, Nebraska

		F:B:A.M.
TYPE.—Left ramus with symphysis and p_2-m_3	(w+)	33735

REFERRED.—

Two horn-cores on cranial fragments (questioned):

Right specimen.....	Fig. 14B	34050
Left specimen (relatively slender).....	Fig. 14B	34024

Eleven mandibular rami:

Mandible with symphysis and p_3-m_3	(w)	34011
Right ramus with symphysis and p_3-m_3	(M)	34012
Left ramus with symphysis and p_2-m_2	(w+)	34001
Left ramus with diastema and p_3-m_3	(w+)	34002
Left fragment with diastema and p_3-p_4	(M+)	33736
Three right rami with p_2-m_3	(M++ TO W+)	34003-5
Right ramus with diastema (br.) and p_4-m_3	(M+)	34006
Two left fragments with p_3-m_2 and p_2-m_3 (br.)....	(w)	34006A, B

Immature:

Right ramus with diastema and dp_2-m_2 (erupting).....	34007
Right ramus with diastema, p_1 alveolus, dp_2-m_1 ..	34013
Left ramus with dp_2-m_2	34007B

Four maxillary specimens:

Left maxilla with p^2-m^3	(w+)	34008
Three fragments.....	(w)	33737, A, B

Twelve unlisted mandibular rami, F:B:A.M. Coll.

See limbs, page 183.

(2) (?)*Bouromeryx americanus* (Douglass)

From Madison River, Montana

Palaeomeryx americanus DOUGLASS, 1899, Univ. Montana, Thesis, p. 20, Pl. iv, Figs. 2, 3.*Dromomeryx ? americanus* DOUGLASS, 1909, Ann. Carn. Mus., V, p. 472, Pl. LXII, Figs. 1, 2; Pl. LXIII, Fig. 2.

TYPE.—Left ramus with p_2-m_3 . C.M.705
(M+)

Figured by Douglass, 1899,
Pl. iv, Fig. 3; 1909, Pl.
LXII, Figs. 1, 2.

REFERRED.—

Right broken p^3 - m^3 .	C.M.706	Figured by Douglass, 1899,
p^3 = ((14)) mm.	m^3 = 15.7 mm.	Pl. iv, Fig. 2; 1909, Pl.
p^4 = (11)	m^3 = (15.5)	LXIII, Fig. 2.

[Douglass remarked that the dimensions of this specimen approximated *S. antilopinus* (Scott).]

Fragment of right ramus with p_4 - m_2 . (w+)	A.M.9753	From Madison River.
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(2a) *Bouromeryx madisonius* (Douglass)

From Western Montana

Palaeomeryx madisonius DOUGLASS, 1899, Univ. Montana, Thesis, p. 23.

Dromomeryx madisonius DOUGLASS, 1909, Ann. Carn. Mus., V, p. 473, Pl. LXII, Figs. 5, 6.

TYPE.—Ramus with three broken molars. C.M.755
Teeth slenderer and unworn crowns taller-appearing than in C.M.705.

TENTATIVELY REFERRED.—

p^3 C.M.2146

(3) *Bouromeryx pawniensis*, new species

From Pawnee Creek, Colorado

Several mandibular specimens, with teeth of considerably smaller size than the smallest examples of *Procranioceras* from Devil's Gulch, are placed in the above species. It is recalled that *Cranioceras* is known from Pawnee Creek in a single horn-pedicle specimen. The Colorado teeth are slightly larger than in *B. nebrascensis*.

TYPE.—Partial right ramus F:A.M.31290 From two miles W. of Mastodon Quarry, 1931.
with p_2 alveolus and p_3 - m_3 .
(w) This paper, Fig. 7.

REFERRED.—

Right fragment with m_7 - m_3 and alveoli. (M+)	F:A.M.31291	From Section 8, 1931.
Right and left m_1 s, left m_3 .	F:A.M.31292,A,B	

Smaller-sized:

Left m^1-m^2 . (w)	F:A.M.31293	From Section 8, 1931.
m^1 right.	F:A.M.31293A	

(4) **Barbouromeryx trigonocorneus** (Barbour and Schultz),
genotypic species

From Antelope Creek, Dawes County, Nebraska

Dromomeryx trigonocorneus BARBOUR AND SCHULTZ, 1934, Amer. Mus. Novitates, No. 734, p. 4, Fig. 1 (in part).

GENOTYPE.—Partial skull, N.S.M.3-27-11-33 From $3\frac{1}{2}$ mi. S., $9\frac{1}{2}$ mi. W. of Hay Springs, on S. side of Antelope Creek, Dawes County, Nebraska. Collected November 27, 1933. Prepared by F. Walker Johnson, Univ. Nebraska, '34. Figured by Barbour and Schultz, 1934, Fig. 1; this paper, Figs. 2, 5, 7, 10, 14; limbs, Fig. 25.

complete except for right horn-pedicle and muzzle anterior to cheek-tooth series, with p^2-m^3 present; right and left rami with I_1-I_3 , /C, and p_2-m_3 ; and skeletal elements (see page 183). (M)

The authors observe: "During the preparation of the skull, a long xiphoid tusk was found in the matrix near the palate. The association is intimate enough to warrant the assumption that this is, in fact, a canine of this specimen and not that of some stray *Blastomeryx* buried there intrusively."

As noted above, the eruption of the teeth is only just complete and it might seem that with age the height of the horn-pedicles would have increased.

REFERRED, COLLECTED AT B QUARRY LOCALITY BY TED GALUSHA, THE DISCOVERER OF THE TYPE, 1935-36.—

		F:B:A.M.
Right ramus with p_2 alveolus and p_3-m_3	(w+)	32872A
Right ramus with p_4-m_3 and alveoli.....	(w++)	32872
Left p_3-p_4	(w++)	32873
Right m_1-m_3 (slightly smaller).....	(w++)	32873D
Right m_1-m_3	(w+)	32873A
Left m_2-m_3	(w+)	32873B
Right m_2-m_3	(w++)	32873C
Left dp_4-m_1		32873F
Right maxilla with p^4-m^3	(M+)	32869
Detached right m^1 (and fragments)		32869A

(5) *Probarbouromeryx sweeti*, new subgenus and species

From Quarry 1, Bridgeport, Morrill County, Nebraska

(Molars smaller than in the preceding species, but averaging larger than in *Parablastomeryx gregorii*.)

SUBGENOTYPE.—Right and left frontlets preserving portions
of horn-pedicles and superior borders of orbits with
lacrimal indentations. *Fig. 14* 53-25-6-35

N.S.M.

REFERRED (collected together with the type by Messrs. Schultz, Meade, Rathbun
and Franzan).—

HORN-PEDICLE

Left horn-pedicle on frontlet (pedicle slightly larger and
externally more hollowed). *Fig. 14* 93-25-6-35

RAMI

Right ramus with symphysis and p_2-m_2 (p_3 br.) (M+) 57-6-7-34
Left ramus with p_3-m_3 *Figs. 4, 4A* (M+) 97-25-6-35
Left fragment with symphysis and p_2-m_1 (W) 95-25-6-35

Slightly smaller:

Left ramus with symphysis and p_2-m_3 *Fig. 4* (M+) 21-25-6-35
Left ramus with p_2-m_3 (M) 20-25-6-35
Left ramus with p_2 alveolus and p_3-m_3 (W) 80-6-7-34
Right fragment with symphysis, p_2 alveolus and p_3-p_4 (M) 130-25-6-35
Right fragment with symphysis, p_2 alveolus and p_3-p_4 (W) 99-25-6-35
Left fragment with p_2 alveolus and p_3-m_2 (W) 129-25-6-35
Right fragment with p_3-m_2 (M) 75-6-7-34

Some fifteen ramal fragments; and fragments of rami
[from Quarry 2], of similar proportions to the above
slightly smaller specimens.

MAXILLÆ

Left maxilla with p^2-m^2 *Fig. 4A* (M) 14-25-6-35
Right maxilla with p^4 (br.)- m^3 (W) 13-25-6-35
Right maxilla with p^3 (br.)- m^3 (W+) 42-25-6-35
Several fragments.

CANINES

N.S.M.

Large Cs/, two unworn, two worn.....	27-, 26-, 25- and 114-25-6-35
Nine large to smaller partial Cs/.....	28-25-6-35, etc.

IMMATURE RAMAL DENTITIONS

Left ramus with symphysis, dp_1 , dp_2 alveoli and dp_3-m_1 .	54-6-7-34
Left fragment with dp_4-m_2	94-25-6-35

Slightly smaller-sized:

RAMI

Right fragment with m_1-m_2	(M)	19-25-6-35
Left fragment with m_1-m_2	(W+)	74-6-7-34

MAXILLÆ

Right fragment with m^1-m^2	(M)	28-25-6-35
Left fragment with m^2	(W)	29-25-6-35

Larger-sized variation (from Quarry 2):

Right fragment with m_1-m_2	(M++)	25-1-9-32
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See Limb Section, page 184, for collection of elements including metacarpus and metatarsi from Quarries 1 and 2 of more slender proportions than *B. trigonocorneus*.

(6) *Protobarbouromeryx marslandensis*, new subgenus and species

From Lower Miocene, Box Butte County, Nebraska

SUBGENOTYPE.—Left ramus N.S.M.3-24-7-34 From 11 miles S.W. of Marsland.
with p_2 alveolus, p_3-m_2 .
(w) This paper, *Figs. 4, 4A*.
(Premolars smaller-proportioned but general size of /ms approximating *P. sweeti*.)

TENTATIVELY REFERRED.—

Left m_2 .	N.S.M.7-26-7-34	From Dawes County, 6 miles W. of Marsland.
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Subfamily 4.—*Drepanomerycinae*VI. *DREPANOMERYX* SINCLAIRVII. *MATTHOMERYX*, NEW SUBGENUS

Figures 1D-E, 15 and (in part) 10, 12A

Statement

Two extremely interesting forms, *Drepanomeryx* and *Matthomeryx*, based on peculiar horn-pedicles, are held together provisionally in this subfamily. The strangely formed type horn-pedicles agree to the degree that they are directed posteriorly, widely bowed inwardly, moderately twisted and have bulbous-formed tips. The pedicle distally is expanded in *Drepanomeryx* and narrowed in *Matthomeryx*. The dentition of *Matthomeryx*, as seen in referred mandibular specimens, is characterized by large *Dromomeryx*-like molars, extremely moderate-sized premolars and open p_4 . The dentition of *Drepanomeryx* is not definitely recognized. (See discussion, page 49.)

VI. *Drepanomeryx*.—The genotype and only definitely known specimen has been credited to the Lower Snake Creek. A broken, triangular-shaped facet, occurring at the postexternal base of the horn-pedicle, is suggestive of the one-time presence of a small postlateral flange. This facet lies on the postero-externally sweeping edge that is continuous with the wedge-shaped inner ridge. The attached cranial fragment carries portions of the supra-orbital foramen, the superior border of the orbit, and the production of the postorbital process with a deep groove separating the outer orbit from the cranium. Through the courtesy of Doctors Sinclair and Jepsen, I am able to refigure this specimen. In the original discussion, Sinclair (1915) observes, in regard to the horns: "...Rising immediately above upper posterior margin of orbit, sloping backward and upward and at the same time curving inward, at base almost circular, but flattening upward in the transverse plane extending backward and inward from the orbits, producing a scimitar-like structure which curves inward toward its fellow on the opposite side..." (See reconstruction, Fig. 1E.)

The writer once surmised that the ramal dentitions listed under *Sinclairiomeryx* might possibly prove to represent *Drepanomeryx* or a closely allied form—but welcome recent evidence now witnesses the unique character of the paired horn-pedicles and nasal bosses of the former genus.

VII. *Matthomeryx*.—The subgenotypic specimen, a portion of cranium with both horn-pedicles attached, collected by T. Galusha from Dawes County, was received long after these pages were in press. The strongly backward direction of the pedicles, their posterior position over the orbits and general form, as shown in adjacent illustrations (Fig. 15), are highly suggestive of the *Drepanomeryx* genotype. Distally the pedicles are narrowed rather than expanded, as in the latter. The position of the orbit relative to the m^3 is evidently posterior. (See reconstruction, Fig. 1b.) The mandibular symphysis and diastema are elongate, the proportions of the posterior mandible unusually large relative to the molars and the premolars are reduced, versus *C. granti*.

It is possible that the two partial crania with strongly posteriorly placed orbits, listed below, may represent (*Matthomeryx* or) *Drepanomeryx*. One of the specimens exhibits a very rudimentary postorbital horn, such as might be expected in a female, see Figure 12A; the second specimen lacks the supra-orbital area. The worn teeth of the two specimens, so far as observable, do not definitely differ from those of *Matthomeryx* referred dentitions.

Summary of Drepanomerycine Species

Drepanomeryx Sinclair.

Horn-pedicles directed posteriorly, strongly bowed inwardly, shafts slender and tips expanded.

- (1) *Drepanomeryx falciformis* Sinclair, genotypic species, from Sioux County, Nebraska.

GENOTYPE.—Left and detached partial right horn-pedicles, P.U.12072. This paper, Fig. 15.

Matthomeryx, new subgenus.

Horn-pedicles, as far as observable, differ from *Drepanomeryx* in their heavy proportions and narrow, unexpanded tips.

- (2) *Matthomeryx matthewi*, n.subg. and sp., from Dawes County, Nebraska.

SUBGENOTYPE.—Partial skull preserving the orbits and large, backwardly directed horn-pedicles, F:B:A.M.33740. This paper, Fig. 15.

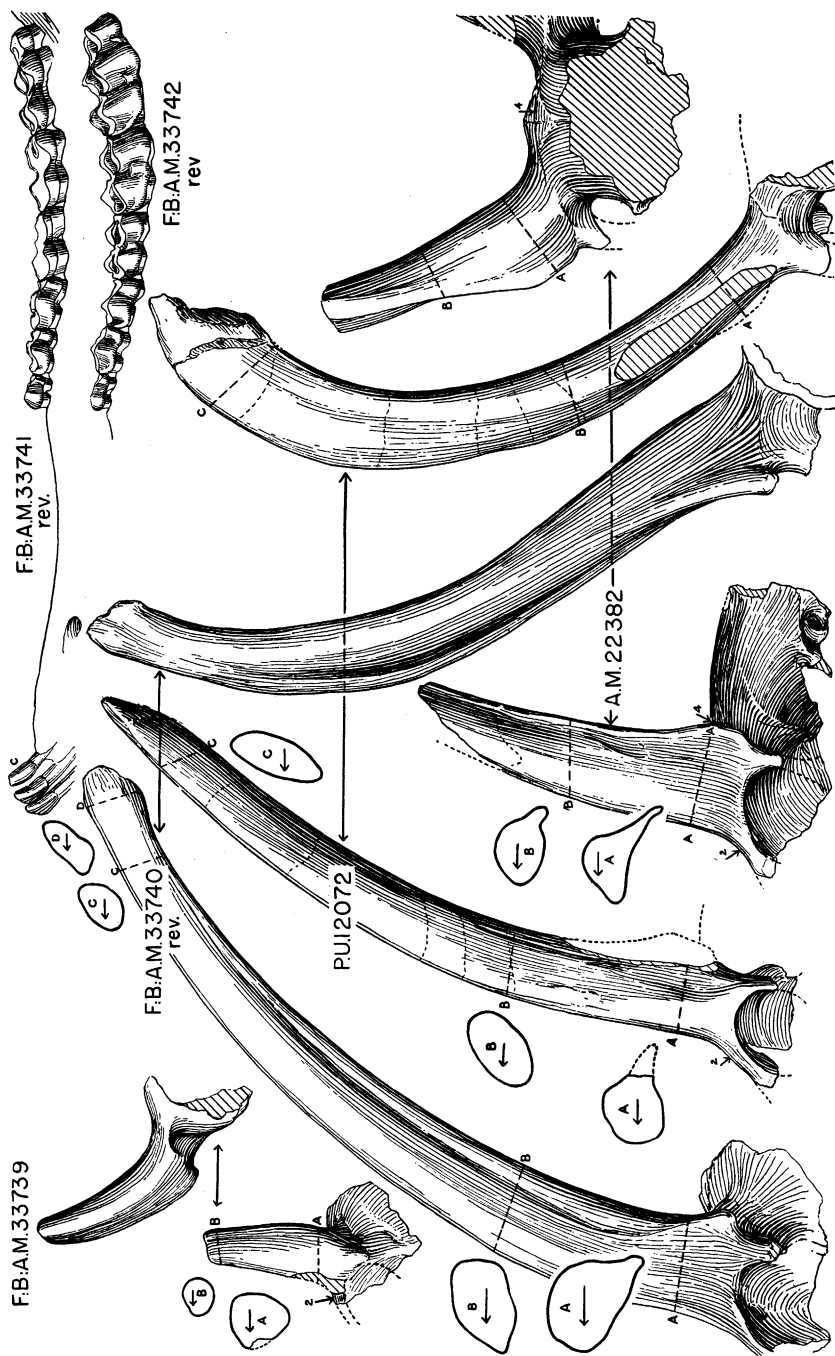


FIG. 15. F.B:A.M.33740 (subgenotype), 33739 (immature), 33741 (rev.) and 33742 (rev.), *Mathomeryx mathewi*, n.subg. and sp., from Observation Quarry, Dawes County, Nebraska.

P.U.12072, *Drepanomeryx falciformis* Sinclair, genotype, from Sioux County, Nebraska.

A.M.22382, (?) *Drepanomeryx* species, from Sioux County, Nebraska.

× ½ (dentition × ½). A, B, C, D, cross sections; 2, supra-orbital foramen; 4, frontoparietal suture. (See pages 141, 140.)

Detailed Lists of Types, Referred Specimens, and Synonymy

VI, *DREPANOMERYX* SINCLAIR AND VII, *MATTHOMERYX*, NEW SUBGENUS*Drepanomeryx*, total available listed specimens, 5; *Matthomeryx*, 17.(1) *Drepanomeryx falciformis* Sinclair, genotypic and only known species

From Sioux County, Nebraska

Reconstruction, Figure 1e

Drepanomeryx falciformis SINCLAIR, 1915, Proc. Amer. Phil. Soc., LIV, p. 90, Figs. 14 and 15.

GENOTYPE.—Left horn-pedicle (tip lacking) on cranial frag- ment and detached portion of right horn-pedicle.	P.U.12072 Loc. 1000C	From Snake Creek beds. Figured by Sinclair, 1915, Figs. 14 and 15; this paper, <i>Fig. 15.</i>
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(Notable for increase of width distally—suggestive of fallow-deer antler.)

(The ramus with p_2-m_1 , premolars relatively large and unreduced, and /C alveolus [H.C. Collection 365], as figured by Harold Cook (1922, p. 21), is more suggestive of the Camalidæ.)

(1a) Indeterminate species

From Sioux County, Nebraska

EXAMPLE.—Top of cranium with horn-pedicles.	A.M.22382	From Sinclair Draw, Sheep Creek Channel, 1927. This paper, <i>Fig. 15.</i>
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QUESTIONABLY REFERRED.—

(a) Large portion of pos- terior cranium, ? ♀, with p^2-m^3 . (w+)	A.M.18879	From same locality, 1921. This paper, <i>Fig. 12A.</i>
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(Discussed and referred by W. D. M. (1924, p. 198) to *Blastomeryx* (*Dyseomeryx*) *sinclairi* (Matthew), the ramal type of which now is tentatively transferred to *C. unicornis* Matthew.)

(b) Portion of anterior skull with both maxillæ with p^3-m^2 . (w+) (Hereto- fore catalogued under <i>Neotragocerus</i> .)	A.M.22383	From Sinclair Draw, Sheep Creek Channel, 1927.
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(c) Left fragment with p^2- m^1 .	F:A.M.31211	From Stonehouse Draw, 1932. This paper, <i>Fig. 10.</i>
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(2) **Matthomeryx matthewi**, new subgenus and species

From Observation Quarry, Dawes County, Nebraska

Reconstruction, Figure 1D

Collected by Ted Galusha, 1936

SUBGENOTYPE.—Cranial fragment with orbits and large, backwardly directed horn-pedicles. *Fig. 15* F:B:A.M. 33740

TENTATIVELY REFERRED.—

Immature left horn-pedicle. *Fig. 15* 33739
 Immature left horn-pedicle. 34023

Eleven mandibular rami and three doubtfully referred maxillary specimens:

Right ramus with symphysis, two /Is, /C and p_2 - m_3	(w++)	33741
	<i>Fig. 15</i>	
Partial mandible with symphysis and both p_2 - m_3 s.	(w)	33746
Partial mandible with p_2 - m_3	(M+)	33751
Left ramus with symphysis and p_2 - m_3	(w++)	33747A
Right ramus with p_2 - m_3 , angle and vertical ramus	(w)	33742
	<i>Fig. 15</i>	
Right ramus with p_2 - m_3	(M)	33743
Left ramus with diastema and p_2 - m_3	(w++)	33744
Right ramus with symphysis and p_2 - m_3	(w+++)	33747
Right ramus with p_2 - m_3	(M++)	33770
Immature right fragment, p_1 alveolus, p_4 germ, dp_2 - m_2 . . .		34025
Left ramus with symphysis and p_2 - m_3 . (Smaller than any of the above.)	(w)	33745
Right maxilla with p^2 - m^3	(w)	33748
Left maxilla with p^3 (br.)- m^3	(w+)	33748A
Right fragment with p^4 - m^3	(M+)	34021A

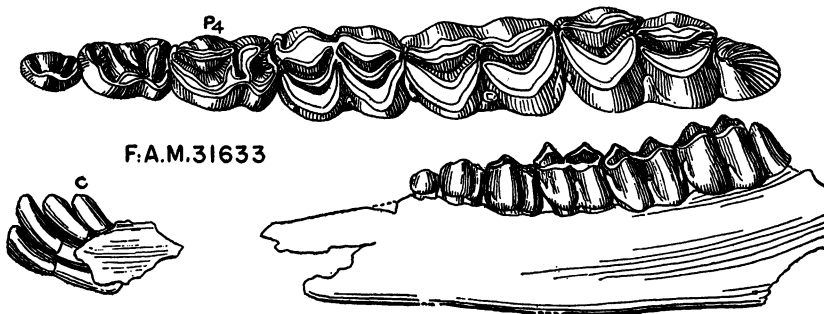


FIG. 15A. *Yumaceras falkenbachii*, n.sp., type (F:A.M.31633), from Guymon, Oklahoma.

Lateral view $\times \frac{1}{2}$, occlusal $\times 1$. (See also Fig. 2B and page 144.)

DIVISION B.—ALETOMERYCINI

Subfamily 5.—*Yumaceratinæ*

VIII. *YUMACERAS*, NEW GENUS

Figures 15A and (in part) 2B, 3, 9, 11, 12A, 14A

Statement

A number of moderately large to large-sized dentitions from Yuma County, Colorado, Roberts County, Texas, Texas County, Oklahoma, and Kansas, in which the tooth crowns are subhypsodont, the premolars reduced and the p_4 anteroposteriorly compressed with the forward fossette closed, are tentatively grouped under the genus. It is worthy of note that while the remains are associated in the several formations with species of *Texoceros*, n.g., the Merycodontini and the more typical of the Dromomerycini seem to be absent. Of the four species and variants recognized here, the two from Yuma County, Colorado, are the largest and may possibly prove subgenerically distinct from the more moderate-sized form from Guymon and its still smaller variant from Miami. The Guymon specimens approximate *Dromomeryx* in size. As compared to the latter, the premolars are notably compressed anteroposteriorly; the p_4 anterior fossette, as noted above, is similarly closed; the teeth are considerably taller-crowned and the "*Palæomeryx*" fold is absent; and, while the molars tend to be larger, the premolars are smaller, the p_2 notably so. The teeth, as giraffe-like as deer-like, differ in proportions from those of any Artiodactyl known to me. While the number of occurrences of teeth and jaws at Guymon seem to indicate the possibility of securing data as to the crania and horns, to date all efforts have been unrewarded. The genotypic species is based on a cranial saddle with horn-core bases (Col.M.214) from Yuma County, Colorado, figured by Harold Cook (1922) under "*?Cervid*, genus and species indeterminate." It is surmised that the genotypic species is represented by the portion of a mandibular ramus from the same area. The teeth of this specimen considerably exceed in size the largest *Dromomeryx*. The particular horn-cores, which are of oval-triangular basal cross section, evidently were widely divergent. The specimen at first glance is not unsuggestive of a very heavy-skulled pronghorn, but the "horns" are not compressed and the general characters and proportions are quite

different from *Antilocapra*. Broadly considered, the specimen perhaps has more of the general appearance of *Cranioceras* than of any other form so far available to the writer. (See discussion, page 50.)

Summary of Species

The several species and variants, one based on the above-mentioned cranial saddle and four on portions of dentitions, are:

- (1) *Yumaceras figginsi*, n.g. and sp., from Yuma County, Colorado.

GENOTYPE.—Frontal saddle with horn-pedicle bases, Col.M.214.

This paper, *Fig. 12A*.

- (1a) More moderate-sized species.

EXAMPLE.—Left ramal fragment, Col.M.(3)222b.

- (1b) *Yumaceras*, genotypic-sized species, from Clark County, Kansas.

EXAMPLE.—Right m², F:A.M.30913.

- (2) *Yumaceras falkenbachii*, n.sp., from Guymon, Texas County, Oklahoma.

TYPE.—Left ramus, F:A.M.31633. This paper, *Figs. 2B, 15A*.

- (2a) Variant, from Miami Quarry, Texas.

EXAMPLE.—Left ramal fragment, F:A.M.31522. This paper, *Fig. 9*.

Detailed Lists of Types, Referred Specimens, and Synonymy

VIII. YUMACERAS, NEW GENUS

Total available listed specimens, 50

- (1) *Yumaceras figginsi*, new genus and species

From Yuma County, Colorado

?*Cervid*, gen. and sp. indet., Cook, 1922, Proc. Col. Mus. Nat. Hist., IV, No. 2, p. 13, Figs. pp. 27 and 28.

GENOTYPE.—Frontal saddle
with horn-pedicle bases.

Col.M.214
[or 214(4)]

Figured by Cook, 1922, p. 27;
this paper, *Fig. 12A*.

QUESTIONABLY REFERRED.—

Partial right ramus with p_4 (br.)- m_2 and etc. al- veoli. (-M)	Col.M.214B .	Figured by Cook, 1922, p. 28; this paper, <i>Fig. 9</i> (Col. M. 200).
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(Lower premolars relative to molars very small-proportioned versus
Rangifer, and smaller-proportioned than in *Dromomeryx*.)

Upper molar (br.). (w+)	Col.M.196
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See Limb Section, page 184.

(1a) *Yumaceras*, More Moderate-Sized Species

From Yuma County, Colorado

EXAMPLE.—Left ramal frag- ment with p_2 - m_1 . (w+) (Smaller.)	Col.M.(3)222b	Cook, 1922, p. 13, noted "?" <i>Palaeomeryx</i> , sp."
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(1b) *Yumaceras*, Genotypic-Sized Species

From Clark County, Kansas

EXAMPLE.—Right m^2 .	F:A.M.30913	From J. Dakin Quarry, 1936.
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(See Limb Section, page 184.)

(2) *Yumaceras falkenbachii*, new species

From Guymon, Texas County, Oklahoma, 1934-35

TYPE.—Left ramus with /Is, /C and p_2 - m_3 . (M+)	F:A.M.31633	F.A. ¹ This paper, <i>Figs. 2B, 15A</i> .
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(p_2 notable small versus following specimens.)

REFERRED.—

Left ramus with p_2 - m_2 and base of m_3 . (M+)	F:A.M.32104	R.D. This paper, <i>Fig. 9</i> .
Right fragment with p_2 - p_4 , broken m_1 - m_3 . (w)	F:A.M.31670	H.D.
Right p_4 - m_3 . (w++)	F:A.M.31673	R.D. This paper, <i>Fig. 9</i> (m_2 only).
Left fragment with dia- stema.	F:A.M.32135 ²	H.D.

¹ LOCALITIES: F = Flats, H = Highway, R = Railroad or Railroad Cut.
HORIZONS: A = Top Sandy Clay, C = Sandy Clay, D = Sand.

² Right p_4 - m_3 (w), F:A.M.33201, from H.D.

Left ramus with diastema, dp ₁ -m ₂ , germs of p ₃ -p ₄ .	F:A.M.32134	R.D. This paper, <i>Fig. 9</i> .
Left dp ₁ -m ₂ and germs of p ₂ -p ₄ .	F:A.M.32146	H.C. This paper, <i>Fig. 3</i> .
p ₃ (small, see F:A.M. 31522, Miami).	F:A.M.32136	F.D.
Left dp ₃ (br.), dp ₄ (br.), m ₁ -m ₂ and germs of p ₂ -p ₄ .	F:A.M.33200	H.C.
Right m ₁ . (w+)	F:A.M.32135B	R.D.
Left m ₂ . (m+)	F:A.M.32135A	H.D.
Four m ₃ s. (m - w)	32135C, D, E, C-1	F.D., H.D., H.C.
Two dp ₄ s.	F:A.M.32136A, B	F.D.
Palate with left p ³ -m ² . (w)	F:A.M.31674	H.D. This paper, <i>Fig. 10A</i> .
Left maxilla with p ⁴ -m ³ . (w++)	F:A.M.31676	H.D. This paper, <i>Fig. 10A</i> (m ³ only).
Right p ² . (w+)	F:A.M.31677	F.D.
Right p ³ . (w)	F:A.M.31677C	F.D.
Three p ⁴ s. (m+ - w++)	31677D, B, A	F.D., H.D.
Three m ¹ s. (m - w+)	31678B, E, I	H.D., R.D.
Two m ² s. (w+, w++)	F:A.M.31678D, H	R.D., F.D.
Five m ³ s. (m - w+)	F:A.M.31678B-1, F, C, G and K	H.D., F.D., H.C.
Two m/ germs.	F:A.M.31678, A	R.D., H.D.
Two dp ⁴ s.	F:A.M.31679, A	H.D., R.D.

(2a) *Yumaceras falkenbachii*, Var.

From Miami Quarry, Texas

(Smaller and near type specimen in size.) (Compare *Pediomeryx* STIRTON, 1936, Journ. Pal., X, No. 7, p. 644, Fig. 1.)

EXAMPLE.—Left fragment with only very slightly worn p ₂ -p ₄ .	F:A.M.31522	From upper layer, 1933. This paper, <i>Fig. 9</i> .
Right m ¹ -m ³ . (w++) (Not included in specimen count.)	F:A.M.32883	
Metacarpus. (See Limb Section, page 185.)	F:A.M.31518	From upper layer, 1933.

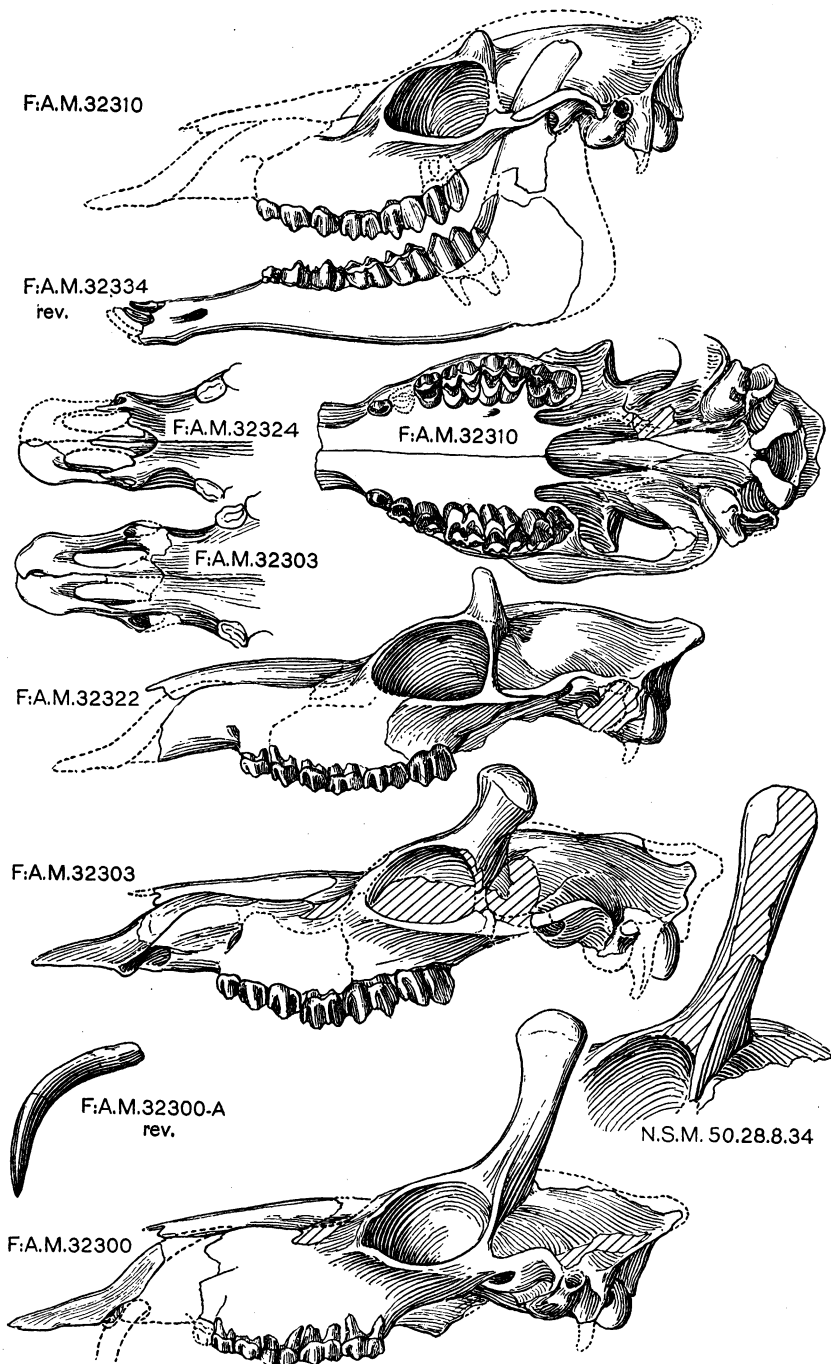


FIG. 16. *Aleotomeryx gracilis* Lull, ref., sexual and individual variation (F:A.M. 32310, 334, 324 and 322 of females; others of males), from Antelope Creek, Cherry County, Nebraska; and *A. marslandensis*, n.sp., type (N.S.M.50-28-8-34), from Marsland, Box Butte County, Nebraska, Middle Tertiary. (Specimens crushed.)

× ½. (See also Fig. 10 [F:A.M.32303], and pages 157-159, 162.)

Subfamily 6.—*Aletomerycinae*IX. *ALETOMERYX* LULL (Middle Tertiary)X. *SINCLAIROMERYX*, NEW GENUS (Late Tertiary)

Frontispiece, D; Figures 1A, 16, 16A, 16B and (in part) 2, 3, 4, 4A, 5, 7, 10;
Limbs (in part) 25A, 25B

Statement

The subfamily proper is characterized by moderate to small size, subhypsodont tooth crowns and strongly reduced premolars, and by the males so far observed having enlarged upper canines and slender horn-pedicles with bulbous extremities that point to the former presence of terminal antlers. Two widely differing genera are recognized, *Aletomeryx* Lull (with which *Dyseomeryx* Matthew is apparently synonymous) and *Sinclairomeryx*, new genus. The molars are very deer-like. Present evidence points to the subfamily being represented so far only by remains from the Middle and earliest Late Tertiary. The *Aletomeryx gracilis* Quarry is considered by Morris F. Skinner to be older than the deposits of the Valentine area, Cherry County. The quarry may well represent a Lower Miocene stage. The American Museum specimens heretofore referred to *A. (Dyseomeryx) marshi* are reported to have come from the Harrison. The *Sinclairomeryx riparius* mandibular rami are of definite Sheep Creek origin. While the faunal association in the case of the University's *Aletomeryx marslandensis* is not unsuggestive of Sheep Creek, the particular pocket is reported by C. Bertrand Schultz as lying stratigraphically within the Harrison. Preceding the detailed listing of the fossil evidence, the characters (also see page 50) of the two tentatively included genera may be discussed briefly:

IX. *Aletomeryx* Lull, the genotypic species *A. gracilis*, was based on remains from the vicinity of Antelope Creek, Cherry County, Nebraska. As observed on a previous page, the genus might be regarded as exemplifying in its subhypsodont tooth crowns, notably reduced premolars, and males with elongate horn-pedicles, a less conservative and more progressive *Barbouromaryx*. The tips of the horn-pedicles afford every indication that the same were once furnished with some manner of capping. (Our reconstruction hazards that such consisted of an antler

somewhat of the form of the European *Dicrocerus*.) Lull has noted that the "horn-cores" (pedicles) were probably covered by skin and hair, as in the case of the giraffe.

Knowledge of the genus recently has been augmented through the remarkable series of specimens of both sexes and various growth stages secured during the summer of 1934 from the vicinity of the type locality by Morris F. Skinner. The series includes, besides several exhibition blocks and yet unprepared material, some twenty-six well-represented skulls, several of which have the premaxilla and large canine alveolus well preserved, and a collection of mandibular rami and limb elements. The new evidence is extremely important through the information afforded as to the variation in horns and body size (metacarpal lengths varying from 116.5 mm. to 129 mm.) occurring in largely contemporaneous members of the one extinct species, and the welcome light that this tends to throw on individual and sexual variation in allied groups. Strangely enough, adequate remains of immature individuals retaining the deciduous dentition, which are so well represented in the case of several of the Merycodontini, seem lacking. The state of wear of the molars affords a ready interpretation to the growth stages exhibited by the horn-pedicles: (a) small to elongate-slender nubs in aged females, (b) small female-like pedicles in adolescent males, and (c) moderate to elongate pedicles in aged to more aged males (see Fig. 16). The average male *Aletomeryx* seems to be larger-toothed than the female.

Characters of *Aletomeryx*.—The cheek teeth are subhypsodont, the premolars reduced, upper incisors lost, upper canine (male) enlarged and lower canine incisiform; the orbits are closed and placed anteriorly, the forward border above m^2 ; the posterior occiput is moderately produced (F:A.M.32305); the nasals are fairly short (F:A.M.32301); the anterior premaxillæ are extended and flattened and posteriorly are in contact with the nasals; a suborbital vacuity is present (the glandular pits of the deer may be absent); the glenoid is very broad; the bullæ are small (F:A.M. 32310); the angle of the mandible is prominently produced (versus Merycodontini and Antilocapriini); the metapodials are slender (in length approximating *Problastomeryx primus*), and lateral splints and phalanges were retained in the manus and lateral phalanges at least in the pes. [Possibly the "splints" are broken remnants of formerly complete metacarpals, as recently observed in (?) *A. marslandensis*, var. (page 163).]

The supra-orbital horn-pedicles are somewhat backwardly directed and dished anteriorly. The convex and tuberos distal ends, as noted

above, give every indication of having once borne some form of horn. The pedicle is particularly well exemplified in the male, F:A.M.32300; the shaft is flat posteriorly, the cross section at the base being broadly triangular, through the mid-extent oval-tending, and through the bulbous tip laterally compressed. The postero-inferior corner is furnished with a narrow vane (reminiscent of the *Dromomerycine* flange) that separates it from the postero-inferior border of the orbit. The inferior corner is continuous with the lambdoidal crests which unite posteriorly. The anterior edge of the pedicle runs upward from the superior border of the orbit. The pedicle is tallest in F:A.M.32300, equaling one-third of the skull length and standing, as in the Yale University specimen, 52 mm. above the orbit; less tall in F:A.M.32301, and again in F:A.M.32303; rudimentary in adolescent female F:A.M.32310; and small and slender in F:A.M.32322, female. A notable variation exists between the aged male and female in skull, tooth, horn and limb dimensions (compare Fig. 16, male F:A.M.32303, versus female F:A.M.32322).

Richard S. Lull (1920) in his description of the genus, observing that Matthew believes *Aletomeryx* to be related to the Antilocapridæ with its nearest relative *Merycodus*, himself considers the genus to be ancestral to the pronghorn. None of the large number of individuals in the Yale Collection, including nineteen or more partial skulls, seems to have indicated that the male retained an enlarged upper canine. Lull considers, "...The distal dilatation of the horn precludes the possibility of a dermal horn... The horns are not antler-like, and hence could hardly have been comparable to those of existing deer... The conclusion reached is that the horns of *Aletomeryx* were covered permanently with hairy skin comparable to those of the giraffe or the developing antlers of the deer. This would be a primitive condition leading to that of the prongbuck on the one hand, where the hair develops into a dermal horn by agglutination, or to the deer on the other, where the velvet is shed, laying bare the osseous antler, which in turn is lost. There is no evidence that the horns of *Aletomeryx* were ever shed... The female horn is merely a low, rounded protuberance with a subtriangular base."

"*Blastomeryx*" *marshi*, described by Professor Lull (1920) from the general Antelope Creek-Fort Niobrara area, was based on a fragmental skull and jaws with worn dentition, large C/ alveoli and rudimentary horn. W. D. Matthew (1924) referred to the species two fragmentary crania (A.M.14264 and A), in the American Museum Collection from the Harrison, and at the same time transferred it to *Dyseomeryx*. Matthew observed these two fragmental crania to differ from *Aletomeryx* in

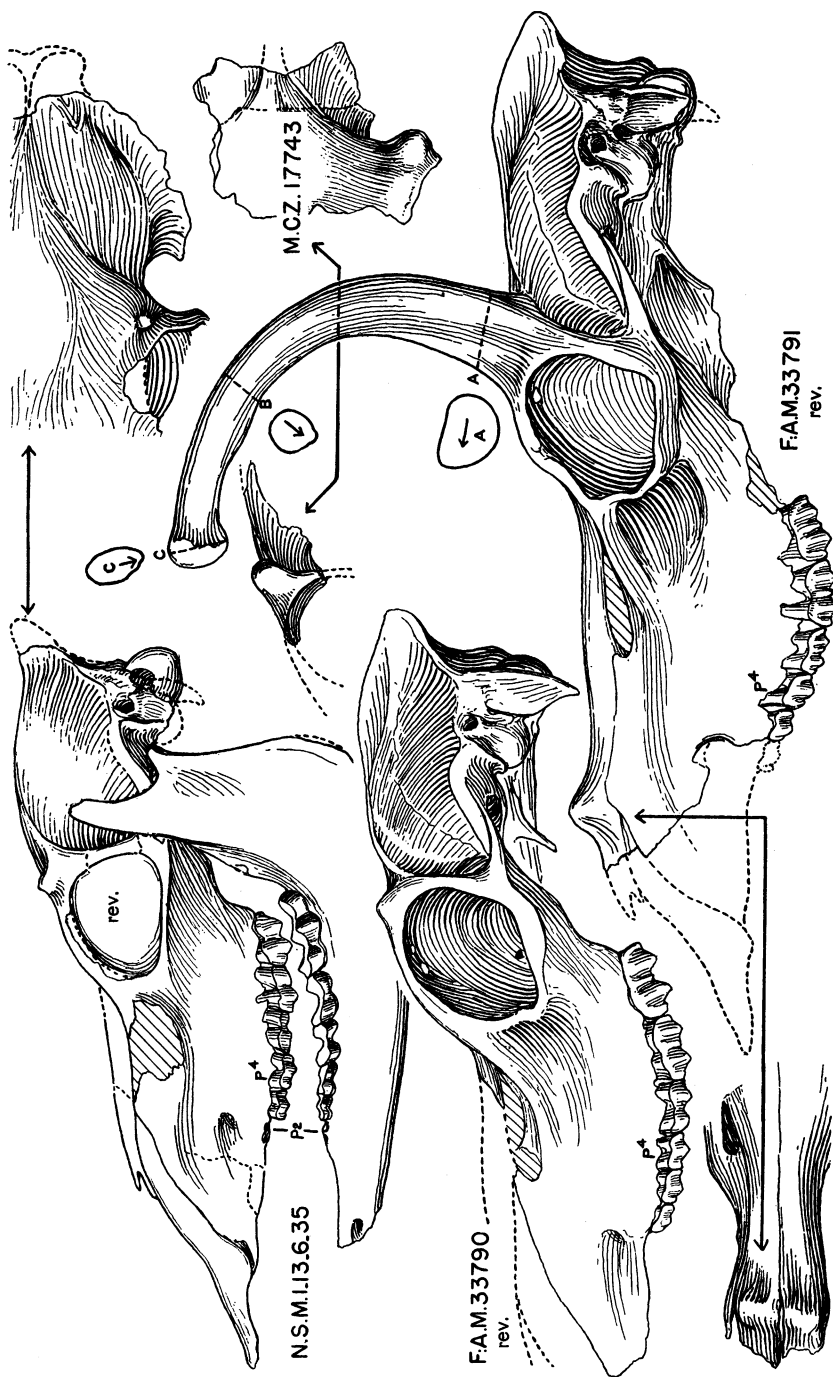


FIG. 16A. N.S.M.1-13-6-35, *Aletomeryx marslandensis*, n.sp., ♀, ref. (skull rev.), from Box Butte County, Nebraska. M.C.Z.17743, *A. scottii* (Matthew), type, from Garman "Loup Fork," Nebraska. F.A.M.33791 (genotype, rev.) and 33790 (♀, ref., rev.), *Sinclairomeryx sinclairi*, n.g. and sp., from Sioux County, Nebraska. X $\frac{1}{2}$. A, B, C, cross sections. (See also Fig. 2 [F.A.M.33791] and pages 162, 161, 164.)

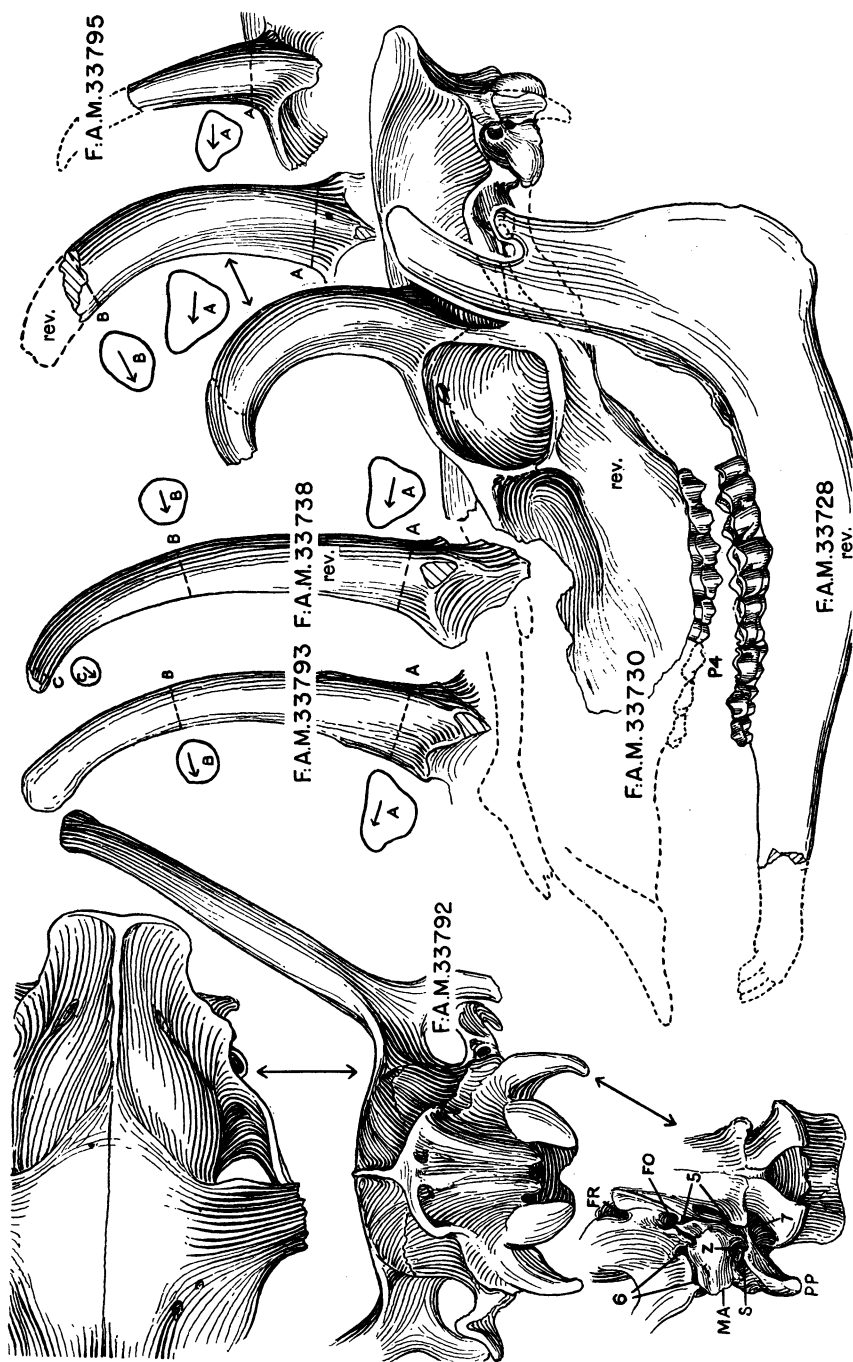


FIG. 16B. *Sinclairomyx sinclairi*, n.g. and sp., ref. (F.A.M. 33792, 33730 [rev., in part], 33728 [rev.], 33793 and 33795 [immature]); and *S. riparius*, var. or species, ref., rev., ?adolescent (F.A.M. 33738), from the Late Tertiary, Sioux County, Nebraska. X $\frac{1}{2}$. A, B, C, cross sections. (For comparison and abbreviations, see Fig. 2A, page 18 [and legend, page 23]; and see pages 164, 165, 167.)

the possession of larger anterior premolars, more rudimentary horn-cores and a differently shaped skull. The specimens in size somewhat approximate *Parablastomeryx gregorii* but differ from the latter in the presence of the rudimentary horn and in the notably smaller-proportioned premolars and larger molars. While *Aletomeryx gracilis* and *Dyseomeryx marshi* may be generically distinct, and even the *Aletomeryx* Quarry remains may include more than one form, the writer suspects that *Aletomeryx* and *Dyseomeryx* represent but one genus. Our large male *Aletomeryx* in its large C/ (unknown to Lull), as in its skull length and cheek tooth series length, resembles the "*D. marshi*" type specimen of Lull's figure 25. Moreover, the metapodial lengths fall within the measurements of our large series of *Aletomeryx* specimens. The reported small size of the pedicles in the "*D. marshi*" fragmental type specimen, in which the teeth are said to be much worn, but the C/ enlarged, suggests an aberrant individual. William D. Matthew (1924), in addition to "*D. marshi*" referred to *Dyseomeryx* certain species from the later Miocene. *Dyseomeryx riparius* Matthew, here transferred to *Sinclairomeryx*; *Dyseomeryx sinclairi* Matthew, questionably transferred to *Cranioceras unicornis*; and *Blastomeryx* (*Dyseomeryx*) *scotti* Matthew, transferred to *Aletomeryx*.

"*Blastomeryx*" *scotti* Matthew, from an indefinite northern Nebraska horizon, represents a larger but presumably closely allied form to *Aletomeryx gracilis*. Lull (1920) observed the similarity between the two species. The "*B.*" *scotti* type, according to Matthew, is the cranial fragment first mentioned by Scott (1890) in his recharacterization of the Cope genus *Blastomeryx*. This specimen (M.C.Z.17743, Fig. 16A), collected by Garman from the "Loup Fork" of Nebraska, and now in the Museum of Comparative Zoology, Harvard University, exhibits a small postorbital excrescence or rudimentary horn-pedicle apparently of the form so well exemplified in several of the new *Aletomeryx* skulls. (Remains held under the same M.C.Z. catalogue number with the type frontal fragment represent six individuals of doubtful reference, i.e., limb elements of four different-sized mature, and tooth fragments of two immature individuals.)

Scott (1890) observed the position of the rudimentary horn to be posterior to the orbit, more as in *Cariacus*, versus over the orbit as in *Cosoryx* and *Antilocapra*. Cope (1878) has stated "... While *Dicrocerus* [*Merycodus*] was probably the ancestor of *Antilocapra*, *Blastomeryx* was the ancestor of *Cervus* or *Cariacus*."

Aletomeryx marslandensis, n.sp., is represented by *A. scotti*-sized remains in which the p_4 tends to be large relative to the much reduced p_2 -

p₃. The specimens were secured from Box Butte County by C. B. Schultz and party, 1934–1936, and placed at the writer's disposal through the courtesy of Professor Erwin H. Barbour. The material includes a frontal saddle with unusually elongate horn-pedicles, and a small collection of maxillary and ramal dentitions with reduced premolars. The horn-pedicles are somewhat taller and the referred dentitions are larger than in the largest known individual of *A. gracilis*. The teeth are smaller than in *Sinclairiomeryx riparius*. The specimens were associated with a partial ramus of an immature individual of *Nanotragulus* and with remains of several Carnivora.

X. *Sinclairiomeryx*, new genus, while paralleling the smaller *Aletomeryx* in slender subhypsodont molars and reduced to much reduced premolars, notably differs from the latter in the slender and curved, paired postorbital horn-pedicles, elongate nasals, nasal bosses and deep maxillary pits. The genus and species are based on one of several partial crania secured from Thomson Quarry by Jack Wilson long after these pages had gone to press. The type is an unusually beautiful cranium, lacking only the premaxillæ and tips of nasals. The genus previously had been known to the writer alone by a series of mandibular rami from the same beds. The genus is named in memory of William J. Sinclair, one of the original investigators of these beds and the describer of *Drepanomeryx* of the same area. In a few unworn dentitions the "Palæomeryx" fold is traceable, though only in most rudimentary condition. The p₄ anterior fossette is unformed; the molars are very deer-like, though the crowns are somewhat shorter and broader and the lobes less deeply incised than in modern deer. While the cheek tooth series is taller, the diastemata lengths approximate those in *Bouromeryx milleri* (actual m₃ lengths vary from near that of the latter to larger than *Procranioceras skinneri*), the molars are lighter built and longer anteroposteriorly, the premolars are notably reduced and the jaws slenderer than in the latter. William D. Matthew (1924) places a similar mandibular ramus from the Sheep Creek type locality under a species of "*Dyseomeryx*," the small genotypic species of which (see above) here is considered to be synonymous with *Aletomeryx*. It is very probable that the present species and the type of *Blastomeryx* (*Dyseomeryx*) *riparius* (A.M.18956) may represent one and the same form. The Sheep Creek form is represented in the new Jack Wilson collection by the above-mentioned partial skulls and a series of mature and a number of immature rami with dp₁–m₁ (erupting). It is interesting to find the dp₁ retained as

in *Dromomeryx*. A maxilla secured at the type locality by Jack Wilson in 1934, seems to evidence the retention of the upper canine. The teeth of this specimen are suggestive of *Aletomeryx* remains in the University of Nebraska collection from Marsland, Box Butte County. (While it is possible that the Sheep Creek remains here divided between the species and variants may represent individual or sexual differences within a single species, the tentative recognition of the variants immediately calls attention to the observed characters.)

The similarity (except for size) between the mandibular dentitions of *Aletomeryx* and the mandibular dentitions referred to *Sinclairiomeryx* and *Yumaceras*, indicate (if the reference is correct) the impossibility of securing satisfactory interpretation of such remains without knowledge of the horn-cores and crania.

On the following pages the known cranial and mandibular remains of the subfamily Aletomerycinae are listed under the two genera and several species. The skeletal elements are considered in comparison with those of the Dromomerycini section as a whole at the end of the chapter, page 169 (see Fig. 25A). The second species tentatively enumerated under *Aletomeryx* may prove, as may the several *Sinclairiomeryx* species, to be respectively synonymous. Crania are figured (Figs. 16, 16A, 16B), illustrating among characters those of the premaxillæ, nasals and horn-pedicle. The drawings show the small size of the *Aletomeryx* horn-pedicle in the mature female and adolescent male, and the relatively large size in the aged male and in the still larger type of *A. marslandensis*. The upper teeth are comparatively figured, Fig. 10, and the lower, Figs. 5 and 7. *Aletomeryx* species (1)–(1b) are relatively smaller and (1c)–(3a) relatively larger.

Summary of Named Species

IX. *Aletomeryx* Lull. (Harrison beds, in part.)

- (1) *Aletomeryx gracilis* Lull, genotypic species, from Cherry County, Nebraska.

GENOTYPE.—Skull, jaws and skeleton, Y.P.M.10732.

- (1a) *Aletomeryx marshi* (Lull), from Harrison beds, Nebraska.

. TYPE.—Skull, mandible, etc., Marsh Coll., Y.P.M.10756.

- (1b) *Aletomeryx gracilis*, var., from Barbour-Hemingford Quarry, Box Butte County, Nebraska.

EXAMPLE.—Right ramus, N.S.M.13-28-7-36.

- (1c) *Aletomeryx scotti* (Matthew), from Garman "Loup Fork," Nebraska.

TYPE.—Frontal fragment, M.C.Z.17743. This paper, *Fig. 16A*.

- (2) *Aletomeryx lugni*, n.sp., from Bridgeport, Morrill County, Nebraska.

TYPE.—Right ramus, N.S.M.13-1-7-32. This paper, *Figs. 4, 4A*.

- (3) *Aletomeryx marslandensis*, n.sp., from Marsland, Box Butte County, Nebraska.

TYPE.—Part of cranial saddle with horn-pedicle, N.S.M.50-28-8-34. This paper, *Fig. 16*.

- (3a) (?) Var., from Dawes County, Nebraska.

EXAMPLE.—Skull, mandible and skeleton, N.S.M.1-11-8-36. This paper, *Fig. 25B* (limb).

X. *Sinclairiomeryx*, new genus. (Sheep Creek beds, in part.)

- (4) *Sinclairiomeryx sinclairi*, n.g. and sp., from Sioux County, Nebraska.

GENOTYPE.—Skull, F:A.M.33791. This paper, *Figs. 2, 16A*.

- (4a) (?) *Sinclairiomeryx riparius* (Matthew), from type area, Sioux County, Nebraska.

TYPE.—Left maxilla, A.M.18956. This paper, *Fig. 10*.

- (4aa) Questioned variant from type locality.

EXAMPLE.—Right ramal fragment, F:A.M.31216. This paper, *Figs. 5, 7*.

- (4aaa) Questioned variants or species, from Thistle and Long Quarries, Sioux County, Nebraska.

EXAMPLE.—Left ramus, F:A.M.32469.

- (5) *Sinclairiomeryx tedi*, n.sp., from Dawes County, Nebraska.

TYPE.—Right ramus, F:B:A.M.32875.

Detailed Lists of Types, Referred Specimens, and Synonymy

IX, ALETOMERYX LULL AND X, SINCLAIROMERYX, NEW GENUS

Aletomeryx, total available specimens, 255; numbered and listed, 192; uncatalogued, 63. *Sinclairiomeryx*, total available listed specimens, 126.

Reconstructions, Frontispiece, D, and Figure 1A

(See limbs, page 185 and Figures 25A, 25B, in part.)

(1) *Aletomeryx gracilis* Lull, genotypic species

From the (?) Middle Tertiary, Cherry County, Nebraska

Aletomeryx gracilis LULL, 1920, Amer. Journ. Sci. (4), L, p. 85, Pl. I and Text-Figs.

GENOTYPE.—Skull.

Y.P.M.10732

From talus slope near the mouth of Antelope Creek, northwestern part of Cherry County, Nebraska.

Figured by Lull, 1920, Pl. I and Text-Figs.

COMPARATIVE MEASUREMENTS

<i>Aletomeryx gracilis</i>		<i>Parablastomeryx gregorii</i>	(After Lull, '20, <i>Parablastomeryx</i> Text-Figs.)	
<i>A. gracilis</i>		<i>g. gregorii</i>	<i>A. gracilis</i>	<i>g. gregorii</i>
Y.P.M. Coll.	F.A.M.31360	F.A.M.31360	Y.P.M. Coll.	F.A.M.31360
p ₁ ...	5 mm.	6.5 mm.	Humerus....	(108) mm. 145 mm.
p ₂ ...	6.7	8.3	Radius.....	(120) 149
p ₄ ...	9	8.5	Metacarpus..	(117) 151
m ₁ ...	12	9	Femur.....	(140) 186
m ₂ ...	13	9.5	Tibia.....	(170) 218
m ₃ ...	16.8	14.3	Metatarsus...	(138) 172

REFERRED.—

Partial skulls, jaws and skeleton (composite), etc., of the Marsh Collection.

Y.P.M.10747, 10744, 10735, 10734, etc.

Some sixty specimens (exclusive of a large exhibition block with numerous skulls and jaws as yet unprepared) were secured by M. F. Skinner from vicinity of the type locality, as discussed under the genus in the introductory statement, page 148. (And see Limb Section, page 185.)

Eleven male skulls (grouped according to p^2-m^3 lengths):

Somewhat crushed skull with moderate horn-pedicles, p^2-m^3 and premaxilla. (M)	F:A.M.	Posterior half skull with partial horn-pedicle.	F:A.M.
$p^2-m^3 = 52$ mm.	32303	Crushed skull with left p^2-m^3 , right $p^4(br.)-m^3$, partial premaxilla. (M+)	32305
Laterally crushed skull, premaxilla, p^2-m^3 . (W+)	32320	Crushed skull with left p^2-m^3 and right p^4-m^3 . (W)	32315A
$p^2-m^3 = 51.3$ mm.			32315
Laterally crushed skull with p^2-m^3 and premaxilla. (W+)	32302	Crushed skull with both horn-pedicles and p^2-m^3 , and partial premaxilla. (W+)	32300
Skull, premaxilla, top of cranium missing. (W)	32293	$p^4-m^3 = 45$ mm.	Fig. 16
Crushed skull with left and broken right horn-pedicles, p^2-m^3 , no premaxilla. (W)	32301	Well-preserved skull with horns, p^2-m^3 , no premaxilla; posterior cranial characters well shown. (M+)	N.S.M. 1-13-7-34
Crushed skull with small horn-pedicles, p^2-m^3 , no premaxilla. (M)	32304	Approximating F:A.M. 32302.	

Fifteen female skulls (grouped according to m^1-m^3 lengths):

Crushed skull, no premaxilla. (W)	F:A.M.	Skull with partial premaxillae and p^4-m^3 . (W)	F:A.M.
Tiny horn-nubs.	32313	Crushed skull with premaxillae and p^2-m^3 . (W++)	32321
$m^1-m^3 = (38)$ mm.		Partial skull with left premaxilla and p^2-m^3 . (W+)	32306
Crushed skull with right p^4-m^3 . (M)	32295	(Horn area gone.)	
Right tiny horn-nub.		Crushed skull with premaxillae. (W++)	32307
$m^1-m^3 = 36$ mm.		Small right horn-nub.	
Crushed skull with right premaxilla and p^2-m^3 . (M+)	32324	Crushed skull with p^2-m^3 , no premaxilla. (W)	32319
(premaxilla)	Fig. 16	Tiny left horn-nub.	
(Horn-nubs not showing.)		$m^1-m^3 = 32$ mm.	
$m^1-m^3 = 35.8$ mm.		Crushed skull with p^2-m^3 . (M)	32294
Skull with short, slender horn-pedicles, p^2-m^3 , premaxillae missing. (W)	32322	$m^1-m^3 = 30.5$ mm.	
$m^1-m^3 = 33.8$ mm.	Fig. 16		
Skull with premaxillae and p^2-m^3 . (W+)	32316		

Crushed partial skull with p^2-p^4 (br.), m^1-m^3 . (w)	F:A.M. 32296	Crushed skull with left horn-nub. (w++)	F:A.M. 32323
Tiny left horn-nub.		Fragmental maxillæ and palates.	
Partial skull with p^2-m^3 . (M) Tiny left horn-nub.	32297	Cs/ of males (F:A.M. <i>Fig. 16</i> Coll.).	(32300A)
Laterally crushed skull with no premaxilla. (w+)	32317		

Eight skulls or partial skulls of adolescent females (grouped according to p^4-m^3 lengths):

Skull with p^2-m^3 , no pre- maxilla. (M)	F:A.M. 32310	Crushed partial skull with left p^4-m^3 and right p^4- m^1 . (-M)	F:A.M. 32314
Tiny horn-nubs. $p^4-m^3 = 41.5$ mm.	<i>Fig. 16</i>	$p^4-m^3 = 40.7$ mm.	
Skull with p^2-m^3 , no pre- maxilla. (M)	32311	Crushed skull with right horn-nub, right p^2-m^3 and left p^2-p^4 . (M)	32308
(Horn-nubs not showing.) $p^4-m^3 = 41$ mm.		$p^4-m^3 = 40$ mm.	
Skull with p^2-m^3 , no pre- maxilla. (M)	32312	Crushed skull with p^2-m^3 . (-M)	32298
Horn-nubs. $p^4-m^3 = (41)$ mm.		Right horn-nub. $p^4-m^3 = 39.6$ mm.	
Crushed skull, palate and part of occiput, right p^2- m^3 and left p^4-m^3 . (-M)	32314A	Crushed skull with p^2-m^3 , no premaxilla; atlas. (M)	32292
$p^4-m^3 = 41$ mm.		$p^4-m^3 = 39$ mm.	

Four immature maxillary dentitions:

Palate with dp^2-m^1 .	32283	Left fragment, dp^2-m^1 .	32309
Partial skull, dp^2-m^1 .	32284	Right fragment, dp^2-dp^4 .	32285

Nineteen mandibular rami (grouped according to series lengths):

Partial mandible with symphysis, p_2-m_3 . (M)	32286	Left ramus with symphy- sis, I_3 and p_2-m_3 . (-M)	32330
$p_4 = 10$ mm.	<i>Fig. 5</i>	$p_4 = 8.4$ mm.	
Left ramus with symphy- sis and p_2-m_3 . (M)	32326	Partial left ramus with symphysis, p_2-m_3 . (-M)	32331
$p_4 = 8.8$ mm.	<i>Fig. 7</i>	$p_4 = 9.4$ mm.	
Left ramus with symphy- sis and p_2-m_3 . (-M)	32325	Partial left ramus with dp_4 about to fall and p_2- m_3 . (-M) (Marked "see skull and limbs.")	32332
Mandible with symphysis, I_3 (erupting), p_2-m_3 . (M)	32287		
$p_4 = 8.8$ mm.			

	F:A.M.		F:A.M.
Mandible with symphysis and p_2 - m_3 . (M+) p_4 = 8.5 mm.	32272	Left fragment, p_2 - m_3 . (-M) p_4 = 8.8 mm.	32335
Left ramus with symphysis, /Is and p_2 alveoli and p_3 - m_3 . (w) p_4 = 9 mm.	32328	Left fragment, p_4 - m_3 . (w) p_4 = 8.8 mm.	32336
Adolescent mandible with symphysis, /Is, p_2 alveoli, p_3 - m_3 and partial skull. p_4 = 9 mm.	32327	Right ramus with symphysis, /C and I_3 erupting and p_2 - m_3 . (-M) p_4 = 9 mm.	32334 <i>Fig. 16</i>
Mandible, p_2 - m_3 . (w) p_4 = 9.7 mm.	32329	Crushed left ramus with symphysis, p_2 - m_3 . (-M) p_4 = 8.8 mm.	32333
Right ramus with symphysis and p_2 - m_3 . (w) p_4 = 8.5 mm.	32288	Left ramus with symphysis with all alveoli and p_2 - m_3 . (w) p_4 = 8.5 mm.	32290 <i>Fig. 5</i>
Left ramus with symphysis and p_2 - m_3 . (w)	32289	Right fragment with p_2 - m_3 . (w+) p_4 = 7.6 mm.	32337
Three immature rami:			
Right ramus with dp_3 - m_1 .	32291	Left dp_2 - m_1 .	32291B
Left dp_1 alveolus and dp_2 - m_1 .	32291A <i>Fig. 3</i>		

(See Limb Section, page 185.)

QUESTIONABLY REFERRED FROM DAWES COUNTY, NEBRASKA.—

Four mandibular fragments with *A. gracilis*-sized teeth have been collected by T. Galusha, 1935-36, from B Quarry, Dawes County, where they were associated with similar-sized but shorter-crowned and unreduced-premolarized dentitions of *Barbouromyx*. See right ramus with p_2 alveolus and p_2 - m_3 , (M), F:B:A.M.32847 and specimens, F:B:A.M.32848, 32873E, 32848A.

(1a) *Aletomeryx marshi* (Lull)

From the Harrison of Nebraska

(See discussion under *A. gracilis*, page 149.)

Blastomeryx marshi LULL, 1920, Amer. Journ. Sci. (4), L, p. 125, Fig. 25.

Blastomeryx (Dyseomeryx) marshi (LULL), MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 196.

TYPE.—Fragmental skull with worn teeth, large C/ alveoli, and reduced horn-pedicles, etc.

Y.P.M.10756

Yale College Expedition of 1873.

Figured by Lull, 1920, Fig. 25.

(?)REFERRED.—

Skull, jaws, ? ♀.

Y.P.M.10937

As figured by Lull, B.L. approximates (162) mm., and series (56) mm.

$p^2 = 6.5$ mm.

$m^1 = 10$ mm.

$p_2 = 5$ mm.

$m_1 = 9$ mm.

$p^3 = 7$

$m^2 = 13$

$p_3 = 7$

$m_2 = 12.5$

$p^4 = 7$

$m^3 = 12.5$

$p_4 = 7$

$m_3 = 17.5$

Length of diastema = 37.5

REFERRED.—

Two specimens collected by Albert Thomson from the Harrison, three miles northeast of Agate, and referred to *Dyseomeryx marshi* (Lull) by Matthew, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 196:

Portion of right side of cranium showing rudimentary postorbital horn-core, p^2 - m^2 ; and ramus with m_1 - m_3 . (w)

A.M.14264

Partial skull with p^2 - m^2 ; and nearly complete mandible with /Is, p_2 - m_3 . (w)

A.M.14264A

(See skeletal elements (A.M.14264) associated with above skulls, Dromomerycine-Aletomerycine Limb Section, page 186, and Fig. 25A.)

In specimen A.M.14264 there is a rudiment of a postorbital horn which in its crushed condition probably appears of larger than actual size. The noticeably posterior position of the orbit is presumably largely an accompaniment of advanced age. The diastema is moderately short and the premolars somewhat small relative to the greatly worn molars. Teeth, metapodials and tibia, so far as may be observed, are all suggestive of *Aletomeryx*. Slender but complete laterals were retained in the manus of A.M.14264A.

(1b) *Aletomeryx gracilis*, Var.

From Barbour-Hemingford Quarry, Box Butte County, Nebraska, 1936

(Not cited on Table I)

EXAMPLE.—Right ramus with p_4 - m_3 (erupting).....

N.S.M.
13-28-7-36

QUESTIONABLY REFERRED.—

N.S.M.

Right fragment with m_1 (br.)— m_2	(M++)	29-28-7-36
Left fragment with m_2 (br.), m_3	(w)	15-28-7-36

MAXILLA

Right fragment with m^2 , m^3	(M)	21-28-7-36
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Smaller specimens from the same locality closely approximate *A. gracilis* in size and might best be referred to that species:

Right ramus with symphysis and p_2 — m_2	(M)	1-28-7-36
--	-----	-----------

Twenty-five ramal and four maxillary dentitions, N.S.M. Coll. Four metacarpi (see page 186) are only very slightly heavier than the largest *A. gracilis*.

Larger species (1c)—(3a):

(1c) *Aletomeryx scotti* (Matthew)

From Garman "Loup Fork," Nebraska

(See discussion under *A. gracilis*, page 152.)

Blastomeryx COPE, referred SCOTT, 1890, Bull. Mus. Comp. Zool., XX, p. 76. (Figs. 7, 8 and 9B are of detached limbs—see footnote¹.)

Blastomeryx (*Dyseomeryx*) *scotti* MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 195.

TYPE.—Fragment of frontal bone with rudimentary horn-core.

M.C.Z.17743

Garman collection.
This paper, Fig. 16A.

(2) *Aletomeryx lugni*, new species

From Bridgeport, Morrill County, Nebraska

TYPE.—Right ramus with diastema, p_2 — p_4 alveoli and m_1 — m_2	(w)	QUARRY 3	N.S.M. 13-1-7-32
		Figs. 4, 4A	

REFERRED.—

FOUR RAMI

(tending larger than type)

Left ramus with diastema, p_2 roots and p_2 — m_2 (br.)...	(w)	3	14-1-7-32
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¹ The number M.C.Z.17743 includes, besides the above supra-orbital fragment, a left ramus with dp_4 — m_2 , and limb elements of three different individuals, which are cited in the Merycodontini Division of this report under *Cosoryx furcatus* in the Limb Section, page 460.

		QUARRY	N.S.M.
Left p_2 alveolus and broken p_2-m_3	(w)	3	9-1-7-32
Right p_2-p_3 alveoli and p_4-m_3	(w)	3	8-1-7-32
Right p_2-p_3 alveoli and p_4-m_3	(m)	2	30-27-9-33

TWO IMMATURE RAMI

Right dp_2-m_1			1-2-7-34
Right dp_2-m_1		3	19-2-7-34

TWO IMMATURE MAXILLÆ

Right dp^3-m^1		3	19-2-7-34
Left dp^3-dp^4		3	19-2-7-34

See Limb Section, page 186, for metatarsi, N.S.M. 6- and 7-1-7-32.

(In length approximating smaller specimens of *Sinclairiomeryx riparius* from Snake Creek.)

(3) *Aletomeryx marslandensis*, new species

From Marsland, Box Butte County, Nebraska

This most interesting species is larger than *A. gracilis* and smaller than *S. riparius*. The only known horn-pedicle resembles, but is considerably taller than, the largest *A. gracilis* pedicle. Cranial characters, as seen in the crushed skull of a female with rudimentary horn-bosses, parallel those of the smaller *Aletomeryx*. The premaxillary tips are broad, spatulate, and the vertical branches narrow and extended, there are no Cs /, the nasals are of moderate length and deeply indented, there is no sagittal crest. The specimens were collected by Messrs. Schultz, Meade, Rathbun and Franzan, and placed at the writer's disposition through the courtesy of Dr. E. H. Barbour.

TYPE.—Top of cranium retaining outline of orbits and both horn-pedicles, left broken.....		N.S.M.
	Fig. 16	50-28-8-34

REFERRED.—

Female cranium, slightly broken posteriorly, with rudimentary horn-bosses, and left ramus; dentition completely represented.....	(w++) Fig. 16A	1-13-6-35
Left maxilla with p^4-m^3 (erupting), etc.....		8-24-8-34
Right maxilla with p^3 (br.)- m^3 (erupting). (Possibly of above individual.).....		41-28-8-34
Left p^2-m^3	(w)	45-28-8-34

Fragment of posterior cranium with small horn-pedicle, left maxilla with p^2-m^3 , mandibular portions with p_2- m_3 (p_4 large).....	(-M)	N.S.M. 5-18-7-34
Left ramus with symphysis and p_2-m_3	(M)	5-18-7-34
Figs. 4, 4A		
Left ramus with diastema and p_4-m_3	(W)	44-11-7-35
Right ramus with symphysis and m_2 (br.)- m_3	(W)	13-19-7-35
Right ramus with p_2-m_3	(M)	5-18-7-34
Left and right partially broken m_1-m_3 (erupting).....	(-M)	5-18-7-34
Fragment with left p_2-m_2 (br.) (p_4 large).....	(M)	1-24-8-34
Fragment with left p_2-m_3	(W+)	8-22-8-34
Smaller-sized:		
Right p^2-m^2	(M)	46-28-8-34
Right ramus with p_2-m_3 (p_2 very small).....	(W)	11-24-8-34
Left m_1 (br.)- m_3	(W)	52-28-8-34
Immature specimens:		
Left maxilla with dp^2-m^2 (br. and erupting).....		13-24-8-34
Right maxilla with dp^3 (br.)- m^1 (erupting).....		11-28-8-34
Left dp^4		12-24-8-34
Left dp_2-m_1 (erupting). (In smallness of dp_2-dp_3 , re- sembles Sheep Creek A.M.18959.).....		7-14-8-34
Left dp_2-m_1 (erupting).....		37-28-8-34
Left dp_2-dp_4		35-28-8-34
Left dp_2-dp_4 (br.).....		12-28-8-34

See Limb Section, page 186, for a longer and a shorter metacarpus.

(Metapodials not as heavy as *B. trigonocorneus*. No longer but slightly heavier than *Sinclairiomyx riparius*.)

(3a) (?)*Aletomyx marslandensis*, Var.

From 15 Miles Northeast of Marsland, Dawes County, Nebraska

EXAMPLE.—A remarkable specimen, including well-preserved hornless skull, mandible, dentition complete, and nearly complete skeleton. p_4 is large relative to greatly reduced p_2-p_3 . Right and left manus retain slender but complete metacarpals II and V. Collected by Grayson Meade. (Not included in count.).....*Fig. 25B* N.S.M.
1-11-8-36

(4) *Sinclairomeryx sinclairi*, new genus and species

From Thomson Quarry, Sioux County, Nebraska

GENOTYPE.—Skull, complete save for premaxillæ and left maxilla, exhibiting paired postorbital horn-pedicles, paired nasal excrescences and p^2-m^2 . (w) [See under (4a).] F:A.M.33791 1936. This paper, *Figs. 2, 16A*.

REFERRED.—

Partial skull (nasals and premaxillæ missing) with portions of right and left horn-pedicles and m^1-m^2 . (w) F:A.M.33730 This paper, *Fig. 16B*.

Portion of cranium with right and base of left horn-pedicles. F:A.M.33792 This paper, *Fig. 16B*.

Portion of skull with left horn-pedicle. F:A.M.33793 This paper, *Fig. 16B*.

Frontal saddle with both horn-pedicles. F:A.M.33794

Portion of frontal with proximal one-half left horn-pedicle. F:A.M.33795 This paper, *Fig. 16B*.

(Immature.)

Detached right horn-pedicle. F:A.M.33731 1933.

Female skull (lacking nasals and premaxillæ) with paired postorbital rudimentary horn-nubs, p^2-m^2 . (M++) Molars of larger size than in preceding specimens. F:A.M.33790 This paper, *Fig. 16A*.

SEVEN RAMI

		F:A.M.
Right ramus with symphysis and p_2-m_2	(w+)	33727
Left fragment with p_2-m_2	(M+)	31386
	<i>Fig. 5</i>	
Left fragment with p_2-m_2	(M+)	31387
		A.M.
Right fragment with p_2-m_2 (br.).....	(M)	20531X
Partial left ramus with m_1-m_2 , etc. alveoli.....	(M)	18958X
Right ramus with symphysis and p_2-m_2 . (Molars less large.)	(M+)	20531

Right ramus with p_2 - m_3 (molars smaller and approximating (w) F:A.M.
A.M.18958, *S. riparius*, ref.); angle, etc., preserved. Fig. 16B 33728

Limb elements may possibly be represented in the series listed under *S. riparius*, page 187.

(4a) (?)*Sinclairiromeryx riparius* (Matthew)

From Type Area, Sioux County, Nebraska

While the premolars of the type maxilla of (?)*S. riparius* seem to be smaller-proportioned than in the type cranium of *S. sinclairi*, the latter eventually may prove to represent the same form as *S. riparius*, which would then take precedence. The molars of the mandibular rami listed below are smaller than in the case of the specimens listed under *S. sinclairi*.

Ramus possibly slighter, postsymphysis to anterior m_1 distance possibly shorter, and premolars, especially p_3 , less reduced, versus *S. riparius*, var.

Blastomeryx (*Dyseomeryx*) *riparius* MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 197, Figs. 58, 59.

TYPE.—Left maxilla with p^2 - m^3 . (M)	A.M.18956	From Stonehouse Draw, Sheep Creek, 1922. Figured by Matthew, 1924, Fig. 58; this paper, Fig. 10.
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REFERRED FROM STONEHOUSE DRAW, COLLECTED BY ALBERT THOMSON, 1922-25 [A.M. NUMBERS] AND JACK WILSON, 1933-34 [F:A.M. NUMBERS].—

Left ramus with symphysis and p_2 - m_3 . (M)	A.M.18958	Figured by Matthew, 1924, Fig. 59; this paper, Figs. 5, 7.
Matthew "paratype."		

NINE RAMI, ETC.

Right ramus with sym- physis and p_2 - m_3 . (M+)	A.M. 21476	Right fragment with p_2 - m_3 and alveoli of /ps. (M)	A.M. 20531A
Partial left ramus with p_2 - m_3 . (M)	18958W	Left fragment with p_2 - p_4 .	18958Z
Left ramus with p_2 alveo- lus and p_2 - m_3 . (M+)	F:A.M. 31222	Right ramus with dia- stema, p_2 - m_3 . (w)	F:A.M. 31390
Partial right ramus with p_2 alveolus, p_2 - m_3 . (M+)	31217	Two badly worn speci- mens.	31391-2

THREE MAXILLÆ

Portion of left maxilla with p^4 - m^3 , alveoli of p^2 - p^3 and indication of re- tention of C/. (-M)	F:A.M. 31246	Left maxilla with p^3 - m^3 . (M+) Fragment with p^3 - m^3 . (w)	A.M. 18957 18957A
--	-----------------	---	-------------------------

Slightly smaller:

THREE RAMI, ETC.

Right ramus with sym- physis, /Is alveoli, p_2 - m_3 . (M)	F:A.M. 31247 <i>Fig. 5</i>	Left fragment with sym- physis, p_2 alveolus, p_3 - m_3 (erupting).	F:A.M. 31247A
Left ramus with diastema and p_2 - m_3 . (W)	31382	Three badly worn speci- mens.	31579A, B, C

IMMATURE INDIVIDUALS

The Stonehouse Draw collection contains a number of rami with milk teeth which are apparently referable to the species. A certain size variation, as remarked above, is noted in the /dps.

SIXTEEN RAMI

Right dp_2 - m_1 (erupting).	A.M. 18845	Right dp_1 - m_1 (erupting).	A.M. 18959 <i>Fig. 3</i>
Right dp_2 - m_2 (erupting).	F:A.M. 31220	Four immature rami.	18959
Right dp_1 - dp_4 .	31219	Two smaller immature left rami.	18959
Right dp_3 - m_1 (erupting).	31394	Left dp_3 - m_1 (erupting). (dp_3 somewhat heavier.)	18959X
Right dp_3 - m_1 (br.). (dp_3 apparently smaller.)	A.M. 20531B	Three fragments.	18959

TWO MAXILLÆ

Right maxilla with dp^2 - m^1 (erupting).	F:A.M. 31221	Left maxilla with dp^2 - dp^4 (br.).	A.M. 18957Y
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(For limb elements referred to this species and the following variants, see Limb Section, page 187.)

(4aa) Questioned Var.

From Type Locality, Sioux County, Nebraska

Characterized by notably small premolars versus (?) *S. riparius*. The size range, as gauged in the m_3 , was about the same as in the species.

EXAMPLE.—Right fragment F:A.M.31216 From Thomson Quarry,
with p_4 - m_3 (erupting). Stonehouse Draw, 1933.
This paper, *Figs. 5, 7.*

REFERRED.—

Four specimens collected by Jack Wilson from the type locality:

Right ramus with diastema, p_2 (br.)- m_3 . (M+)	F:A.M.31214	1934.
Left ramus with diastema, p_2 - m_3 . (M+)	F:A.M.31223	1934.
Left fragment, p_4 - m_3 . (M)	F:A.M.31224	1934.
Right fragment with p_4 - m_3 (br.). (w) (Smallest p_4 .)	F:A.M.31215	1933.

Two fragments collected by Albert Thomson in the same general locality:

Right fragment with p_4 - m_3 (erupting).	A.M.18958U	1922.
Right ramus with symphysis and p_3 - m_3 . (M+)	A.M.18958B	From (?)Sheep Creek beds, 1922.
		This paper, Fig. 7.

(The specimen is somewhat intermediate to the above and *S. riparius* proper.)

(4aaa) Questioned Vars. or Species

From Thistle and Long Quarries, Sioux County, Nebraska

REFERRED FROM THISTLE QUARRY, 1935-36.—

F:A.M.

Detached right horn-pedicle (?adolescent, tip ?slender)....	Fig. 16B	33738
Portion of left horn-pedicle.....		33732

Molars approximating in size Thomson Quarry specimens:

Right ramus with symphysis and p_2 - m_3 (lacking heel).....	(M)	33020
Right fragment with m_2 - m_3	(w)	33020A
Left ramus with symphysis and p_2 - m_3	(M+)	33021

REFERRED FROM LONG QUARRY, 1935.—

A distinct species is probably represented by specimens from Long Quarry in which the teeth are of smaller size than in the above Thomson Quarry specimens, and seemingly more nearly approximating *Aletomeryx* of the Bridgeport Quarry.

F:A.M.

Left ramus with p_4 - m_3	(w)	32469
Right dp_4 - m_1		32469A

(5) *Sinclairiomeryx tedi*, new species

From Ginn Quarry, Dawes County, Nebraska

The remains from Ginn Quarry, collected by Ted Galusha in November, 1935, include a series of fragmental mandibular rami in which the molars are of larger size but the premolars proportionately smaller than in *Barbouromeryx trigonocorneus*. The teeth are slightly heavier but of very similar proportions to the above specimens from Long Quarry. In the immature dentition the dp_2-m_1 , while larger, are of much the proportions of *Aletomeryx* and but very slightly smaller than a specimen from Long Quarry, which itself is moderately suggestive of the Sioux County A.M.18959. In several of the Dawes County immature specimens the dp_1 alveolus tends to be slightly separated from the dp_2 . As compared to an immature *Bouromeryx*, while the dp_4 may be approximately the same length, the dp_2-dp_3 and m_1 are notably smaller.

		F:B:A.M.
TYPE.—Right ramus with diastema and p_1-m_3	(M+)	32875
REFERRED FROM TYPE LOCALITY.—		
Right ramus with p_3 (br.)- m_3	(W)	32876
Left p_1-m_2	(W+)	32876 A
Left ramus with p_1-m_3 (erupting).....		32877
Left ramus with p_1-m_3 (erupting).....		32877 A
Left ramus with m_1 (br.)- m_3	(M)	32877 B
Left ramus with symphysis and p_2-m_3 Figs. 4, 4A	(W+++)	32878
Left ramus with symphysis and p_3-m_2	(W+++)	32878 A
Left ramus with symphysis and p_2-m_2	(W+++)	32878 B
Left p_2-m_3	(W++++)	32878 C
Left ramus with p_1-m_3 and angle.....	(W++++)	32878 D
Several maxillary specimens including:		
Right p^4-m^3	(M+)	32866
Left p^4-m^3	(W+)	32866 A
Immature rami:		
Left dp_2-m_1 (erupting).....		32867
Left dp_2-m_1 (detached dp_1 alveolus).....		32867 A
Left dp_2-m_1		32867 B
Left dp_2-m_1		32867 C
Left dp_2-m_1		32867 D
Right dp_2-m_1		32867 E
Left dp_2-dp_4		32867 F

See Limb Section, page 187.

DROMOMERYCINE AND ALETOMERYCINE LIMB ELEMENTS

Figures 17, 18; and (in part) 25, 25A, 25B

Statement

The collections contain certain detached and a few associated limb elements of relatively heavy proportions. The several cases where such elements are directly associated with skulls, partial skulls, or dentitions, have been useful in the interpretation and tentative allocation of the detached specimens—see detailed lists (page 176). The specimens cover a considerable range in size. Certain of the more typical examples are figured. The largest form is represented by a Yuma County metacarpus referred to *Yumaceras*, n.g., the smallest by the *Aletomeryx* remains. The *Dromomeryx borealis* type limbs and the elements referred to *D. whitfordi* and to *Rakomeryx* species from Nevada and Oregon are of only slightly smaller dimensions than the largest. Remains of more moderate size include a *Rakomeryx* metatarsus from Barstow, and the specimens from Sioux County, Nebraska, hypothetically interpreted as the male of *Cranioceras unicornis*. A fourth group is represented by the Montana *Subdromomeryx antilopinus* type, by moderate specimens referred to *Cranioceras unicornis* from Sioux County, Nebraska, by the slightly smaller elements allocated to *C. (P.) skinneri*, n.subg. and sp., by the associated limbs of the *Rakomeryx* female (and the questioned A.M.8132A, a distal end of radius from Montana) and by elements doubtfully referred to *Bouromeryx*, n.subg. The larger of the elements grouped under *Sinclairiomeryx riparius* form a fifth size group. A sixth and still smaller group is exemplified by the limbs of the *Barbouro-meryx* genotype, and by certain detached elements from Sioux County of smaller size than the last, which are allocated to *S. riparius*. Seventh and eighth size groups are seen in the *Aletomeryx* elements. The retention of extremely slender but complete metacarpals II and V is so far exemplified in but one specimen.¹

¹ (?) *Aletomeryx marslandensis*, pp. 163, 186, N.S.M.1-11-8-36. Fig. 25B.

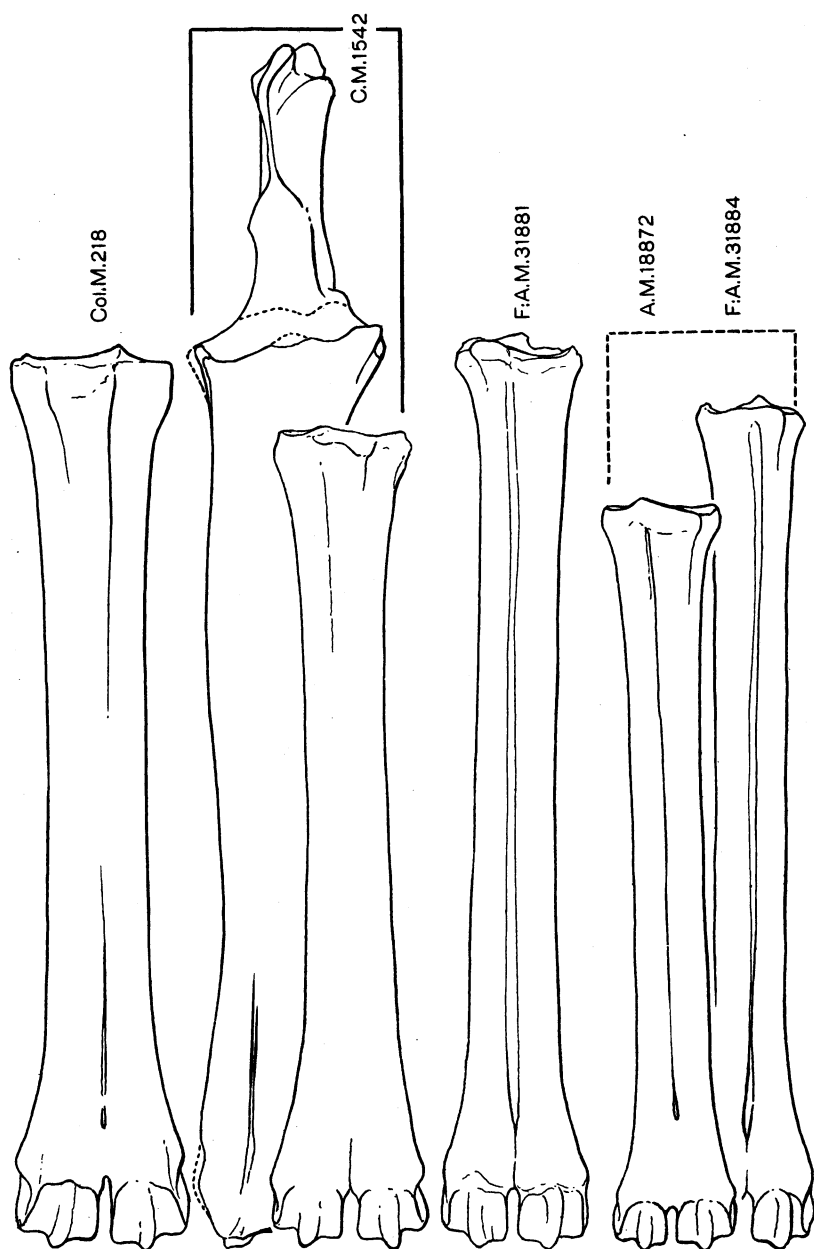


FIG. 17. *Yumaceras*, n.g., *Dromomeryx* Douglass and *Cranioceras* Matthew, comparison of referred limb elements from the Late Tertiary of Colorado, Montana and Nebraska.

× $\frac{1}{4}$. (See legend, page 174.)

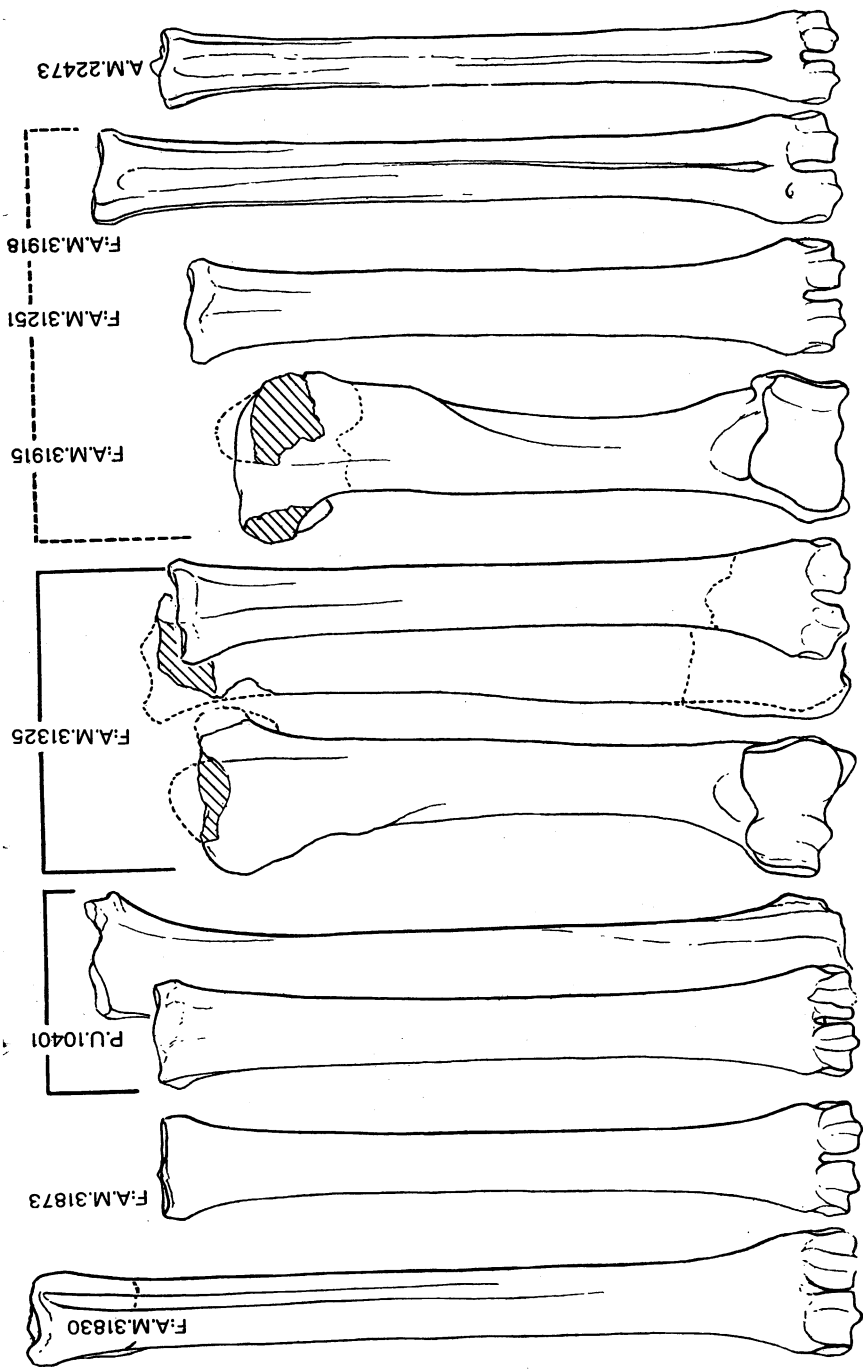


FIG. 18. *Rakomeryx*, n.g., *Cranioceras* Matthew, *Subdromomeryx*, n.subg., *Procranioceras*, n.subg. (and ?*Tezoceros* n.g.), comparison of referred limb elements from the Late Tertiary of California, Nebraska and Montana.
 X ½. (See legend, page 174.)

TABLE III
DROMOMYCINE AND ALETOMYCINE COMPARATIVE LIMB MEASUREMENTS AND RATIOS
[Listed According to Approximate Lengths]

	Collection No.	Limb Size Group ¹	Humerus mm.	Radius mm.	Metacarpus mm.	Femur mm.	Tibia mm.	Metatarsus mm.	% Humerus/Radius	% Metacarpus/ Radius	% Radius/Tibia
<i>Yumaceras figginsii</i> , (?)ref., Yuma Co., Colo..	Col.M.218	I			233						
<i>Y. Y. falckenbachii</i> , var., ref., Miami, Tex.....	F.A.M.31518	IV			176						
<i>Dromomeryx whitfordi</i> , ref., Sioux Co., Nebr..	Unassoc.pp.181-2	II			210	284	290	235		(96)	
<i>Rakomeryx</i> species, ref., Virgin Valley, Nev....	U.C.19417	II		((244))	((235))						
<i>Dromomeryx borealis</i> , ref., Mont.....	C.M.1542	II		237	214		290			90	82
" " " " " "	C.M.827		217	227	220				96	97	
<i>Cranioceras mefferdi</i> , ref., Cherry and Brown Cos., Nebr.....	Unassoc., p. 178	III				251		223-217			
<i>C. unicornis</i> , ref., Sioux Co., Nebr.....	Unassoc., p. 176	III-IV			197-183			218			
<i>C. granti</i> , ref., Cherry Co., Nebr.....	Unassoc., p. 177	IV+			193-179		212	232-207			
<i>Rakomeryx raki</i> (or <i>jorakianus</i>), ref., Barstow, Calif.....	Unassoc., p. 180	III			188			214			
<i>Subdromomeryx antilopinus</i> , ref., Mont.....	P.U.10401	IV+			184		(246)			93	(80)
<i>Cranioceras teres</i> , ref., N. Mex.....	F.A.M.31691	IV		197			225				
<i>Rakomeryx raki</i> (or <i>jorakianus</i>), ref., ♀, Bar- stow, Calif.....	F.A.M.31325	IV 166		181	173				92	95	

<i>Cranioceras dakotensis</i> , ref., E. of Rosebud, S. Dak.....	A.M.22502	IV						198		
<i>C. (P.) skinneri</i> , ref., Brown Co., Nebr.....	Unassoc., p. 177	IV	158		174	(248)		196		
(?) <i>C. clarendonensis</i> , ref., Clarendon, Tex.....	F.A.M.32453	IV						190		
<i>Subdromomeryx scotti</i> , ?ref., Sioux Co., Nebr.	Unassoc., p. 183	V	144-138	(170)-166	165-154	194-187	218-205	187-170		
<i>Sinclairomeryx riparius</i> , ² and var., ref., Sioux Co., Nebr.....	Unassoc., p. 187	V-VI	141	165-140	165-140	177-168	196-182	165-147		
<i>Aletomeryx marslandensis</i> , ref., Box Butte Co., Nebr.....	N.S.M.5-18-7-34	V-VI			156-148			166-154		
<i>Barbouromeryx trigonocorneus</i> , genotype, Dawes Co., Nebr.....	Unassoc.	VI	142	157	143	186	206	164	90	91 76
<i>Probarbouromeryx sweeti</i> , ref., Morrill Co., Nebr.....	N.S.M.3-27-11-33 ³	VI								
<i>Aletomeryx lugni</i> , ref., Morrill Co., Nebr.....	Unassoc., p. 184	VI			140			160		
(?) <i>A. marslandensis</i> , var., Dawes Co., Nebr.	N.S.M.6-1-7-32	VII+						152		
<i>A. gractilis</i> , ref., W. Cherry Co., Nebr.....	N.S.M.1-11-8-36 ⁴	VI	((124))	153	139	155	185	152	((81))	91 84
<i>A. marshi</i> , ref., Sioux Co., Nebr.....	Unassoc., p. 185	VII-VIII	116-((104))	139-121	127-115	((138))-((133))	174-164	141-129		
	A.M.14264 ⁵	VII		127	119		161	133		94 79

() approximate; (()) estimated.

¹ The limb size groups, as here used, are distinct from limb size groups (I-VIII) of the Blastomerycini-Merycodontini subfamilies—*Aletomeryx* Size Groups VII-VIII approximate; the Blastomerycini-Merycodontini Size Groups III-IV.

² Larger specimens may be of *Sinclairomeryx sinclairi* or of *Subdromomeryx*.

³ N.S.M.3-27-11-33... femur/tibia = 90%; metatarsus/tibia = 80%; metacarpus/metatarsus = 87%.

⁴ N.S.M.1-11-8-36... femur/tibia = 86%; metatarsus/tibia = 84%; metacarpus/metatarsus = 91%.

⁵ A.M.14264... metatarsus/tibia = 83%; metacarpus/metatarsus = 89%.

Genera and Species Relisted

Some twenty-seven of the species and subspecies seem to be represented by limb elements; where the association is definite, the species are starred. (Compare species summaries, pages 81, 101, 111, 128, 138, 143, 154, and see measurement table, page 172. Numbers in parentheses refer to species in the preceding discussion of dentitions.) Examples of the limb elements, as previously observed, are comparatively shown in Figs. 17, 18, and (in part) 25, 25A, B, versus a metatarsus of the Antilocaprine *Texoceros*, n.g. (A.M.22473, Fig. 18), and certain Blastomerycini.

The limb size groups, as here used, are distinct from Limb Size Groups I-VIII of the Blastomerycine-Merycodontine subfamilies, *Aletomeryx* Size Groups VII-VIII approximating the Blastomerycine-Merycodontine Size Groups III-IV.

FIGS. 17 AND 18. *Aletomerycini* and *Dromomerycini* (and ?*Texoceros*), comparison of referred limb elements.

× ‡. Solid-line bracket indicates associated limbs; broken-line bracket indicates limbs of more than one individual.

FIG. 17. Col.M.218, *Yumaceras figginsi*, n.g. and sp., tentatively ref., left metacarpus, from Yuma County, Colorado.

(See page 184.)

C.M.1542, *Dromomeryx borealis* (Cope), ref., left radius and ulna, and right metacarpus, from Montana.

(See page 181.)

F:A.M.31881, *Dromomeryx whitfordi* Sinclair, ref., right metatarsus, from Sioux County, Nebraska.

(See page 182.)

A.M.18872 and F:A.M.31884, *Cranioceras unicornis* Matthew, ref., right metacarpus and left metatarsus, from Sioux County, Nebraska.

(See page 176.)

FIG. 18. F:A.M.31830 and 31325, *Rakomeryx raki* (or *zorakianus*), n.sp., ref., left metatarsus and ♀ right humerus, radius and metacarpus, from Green Hills, Barstow, California.

(See also Figs. 8, 10A [mandible, maxilla of F:A.M.31325] and pages 180, 179.)

F:A.M.31873, *Cranioceras unicornis* Matthew, ref., right metacarpus, from Sioux County, Nebraska.

(See page 176.)

P.U.10401, *Subdromomeryx antilopinus* (Scott), right metacarpus and left radius (considered as of same individual as the type), from Deep River, Montana.

(See also Figs. 10, 14A [apparently associated dentition and skull] and page 182.)

F:A.M.31915, 31251 and 31918, *Procranioceras skinneri*, n.subg. and sp., ref., left humerus, right metacarpus and metatarsus, from Devil's Gulch, Brown County, Nebraska.

(See also Fig. 12 [skull and mandible doubtfully associated with F:A.M.31251] and page 177.)

A.M.22473, (?)*Texoceros altidens* (Matthew), ref., right metatarsus, from Sioux County, Nebraska.

(See pages 508, 518.)

* = elements associated

I. *Cranioceras* MATTHEW (AND IA. *Procranioceras*, N.SUBG.)—LIMB SIZE GROUPS III AND IV

- (1) *C. unicornis* Matthew, from Sioux County, Nebraska. This paper, *Fig. 17* (A.M.18872 and F:A.M.31884); *Fig. 18* (F:A.M.31873).
 - (1a) *C. granti*, n.sp., referred, from upper zone, Cherry County, Nebraska.
 - * (2) *C. (P.) skinneri*, n.subg. and sp., referred, from Devil's Gulch, Brown County, Nebraska. This paper, *Fig. 18* (F:A.M.31915, 31918 and 31251).
 - (3) *C. mefferdi*, n.sp., referred, from Cherry and Brown Counties, and (?) (3a) var., from Dawes County, Nebraska.
 - (4) *C. dakotensis*, n.sp., referred, from three miles east of Rosebud, South Dakota.
 - (5) *C. teres* (Cope), from Santa Cruz, New Mexico.
 - (6) *C. pawniensis*, n.sp., referred, from Pawnee Creek, Colorado.
 - (7) (?) *C. clarendonensis*, n.sp., referred, from Clarendon, Texas.
- Species (4a) and (7a) are not represented by limbs.

II. *Rakomeryx*, NEW GENUS—LIMB SIZE GROUPS II AND III (♀ IV)

- * (1) or (2), *R. raki* (or *zorakianus*), n.sp., referred, from Green Hills, Barstow, California. This paper, *Fig. 18* (F:A.M.31830 and 31325).
 - (4) *R. species*, from Virgin Valley, Nevada.
 - (5) *R. gazini*, n.sp., referred, from Oregon.
- Species (3) is not represented by limbs.

III. *Dromomeryx* DOUGLASS—LIMB SIZE GROUP II

- * (1) *D. borealis* (Cope), referred, from Montana. This paper, *Fig. 17* (C.M.1542).
- (2) *D. pawniensis*, n.sp., referred, from Pawnee Creek, Colorado.
- (3) *D. whitfordi* Sinclair, from Sinclair and Antelope Draws, Sioux County, Nebraska. This paper, *Fig. 17* (F:A.M.31881).

IIIA. *Subdromomeryx*, NEW SUBGENUS—LIMB SIZE GROUP IV+ TO V

- * (4) *S. antilopinus* (Scott), from Montana. This paper, *Fig. 18* (P.U.10401).
 - (4a) *S. scotti*, n.subg. and sp., questionably referred, from Sioux County, Nebraska.
- Species (4b) is not represented by limbs.

IV. *Bouromeryx*, NEW SUBGENUS—LIMB SIZE GROUP IV

- (1b) *B. nebrascensis*, n.sp., referred, from Echo Quarry, Sioux County, Nebraska.
 - (1d) (?) *B. pseudonebrascensis*, n.sp., referred, from Dawes County, Nebraska.
- Species (1), (1a), (1aa), (1c), (2), (2a) and (3) are not represented by limbs.

V. *Barbouromeryx*, NEW GENUS—LIMB SIZE GROUP VI

(Dromomerycini Limb Size Groups v to viii approximate Limb Size Groups i to iv of the Blastomerycini series.)

- * (4) *B. trigonocorneus* (Barbour and Schultz), from Antelope Creek, Dawes County, Nebraska. This paper, *Fig. 25* (N.S.M.3-27-11-33).

VA. *Probarbouromeryx*, NEW SUBGENUS—LIMB SIZE GROUP VI

- (5) *P. sweeti*, n.subg and sp., referred, from Bridgeport Quarry, Morrill County, Nebraska. This paper, *Fig. 25A* (N.S.M.29-27-9-33 and 36-27-9-33).

VB, *Protobarbouromeryx*, NEW SUBGENUS, VI, *Drepanomeryx* SINCLAIR, AND VII, *Mathomeryx*, NEW SUBGENUS, are not represented by limbs.

VIII. *Yumaceras*, NEW GENUS—LIMB SIZE GROUPS I AND IV

- (1) *Y. figginsi*, n.g. and sp., (?)referred, from Yuma County, Colorado. This paper, *Fig. 17* (Col.M.218).
 (1b) *Y.* species, from Clark County, Kansas.
 (2) *Y. falkenbachi*, n.sp., referred, from Guymon, Texas County, Oklahoma.
 (2a) *Y. falkenbachi*, var., from Miami Quarry, Texas.
 Species (1a) is not represented by limbs.

IX. *Aletomeryx* LULL—LIMB SIZE GROUPS VII AND VIII

(Metapodials are intermediate to Size Groups II and III of the *Blastomerycine* series.)

- (1) *A. gracilis* Lull, from Cherry County, Nebraska. This paper, *Fig. 25A* (F:A.M. 31931 and 31932); *Fig. 25B* (F:A.M.32248).
 (1a) *A. marshi* (Lull), referred, from Cherry County, Nebraska. This paper, *Fig. 25A* (A.M.14264).
 (1b) *A. gracilis*, var., from Box Butte County, Nebraska.
 (2) *A. lugni*, n.sp., referred, from Morrill County, Nebraska.
 (3) *A. marslandensis*, n.sp., referred, from Box Butte County, and (3a) (?)var., from Dawes County, Nebraska. This paper, *Fig. 25B* (N.S.M.1-11-8-36).
 Species (1c) is not represented by limbs.

X. *Sinclairiomeryx*, NEW GENUS—LIMB SIZE GROUPS V AND VI

- (4a) (?)*S. riparius* (Matthew), and vars., referred, from Sioux County, Nebraska.
 (4aaa) Questioned vars. or species, from Sioux County, Nebraska.
 (5) *S. tedi*, n.sp., referred, from Dawes County, Nebraska.

Detailed Lists of Limb Elements of the Above Genera and Species

I. *Cranioceras* MATTHEW (AND IA, *Procranioceras*, NEW SUBGENUS)(1) *C. unicornis* Matthew

From Sioux County, Nebraska

The male hypothetically exemplified by specimens of smaller size than *D. whitfordi*, and larger size than *S. antilopinus*. (Specimens may represent in part small individuals of *D. whitfordi*.)

EXAMPLE.—Right metacarpus, 197 mm.	A.M.18872	From Sinclair Draw, 1921. This paper, <i>Fig. 17</i> .
Left metatarsus.	F:A.M.31884	From Quarry No. 1, 1932. This paper, <i>Fig. 17</i> .
Calcaneum.	F:A.M.31885	From E. Sinclair Draw, 1933.

The female is apparently exemplified by several moderate-sized specimens.

EXAMPLE.—Left metacarpus.	F:A.M.31870	From W. Sinclair Draw, 1932.
Two left metacarpi.	F:A.M.31871 and 31872	From E. Sinclair Draw, 1933.
Right metacarpus, 183 mm.	F:A.M.31873	From E. Sinclair Draw, 1932. This paper, <i>Fig. 18</i> .
Calcaneum and two astragali.		From Snake Creek area

(1a) *C. granti*, n.sp., referred

From Upper Zone, Cherry County, Nebraska

To this species are allocated a series of metacarpi (see F:A.M.31925 and 31926) of heavier and shorter proportions than typical *Cranioceras granti*, and nearest approached by a specimen (F:A.M.31518) from Miami, Texas. More elongate elements from the same quarry, of smaller size than *Dromomeryx whitfordi* and of larger size than *Subdromomeryx antilopinus*, resemble a Sioux County *Cranioceras* referred metacarpus, A.M.18872.

REFERRED.—

From *Leptarctus* Quarry, 1936 (more recently received specimens):

	F:A.M.
Left radius.....	33716C
Three right and one left metacarpus (B = 193 mm.).....	33717B-E
Two left and one right metatarsus (G = 207 mm.).....	33718E, G, F

From Kat Quarry, 1931, 1933 and 1936:

Two right and one left radius.....	33716, A-B
Two right (31925 = 179 mm.) and one left (193 mm.) metacarpus.....	31925-7
One right and three left metacarpi (G = 185 mm.).....	33717, A, F, G
Right tibia (crushed).....	33718H
Four left and one right metatarsus (33718 = 232 mm.).....	33718, A-D
Two right metatarsi, 212 and (213) mm. (slightly shorter than <i>C. mefferdi</i> referred specimen).....	32070, 32069
Two astragali.....	31923, 31248A

From Bear Creek, 1934:

Left metatarsus.....	32404
Two astragali.....	32404A, B

The largest metacarpus, F:A.M.33717B = 193 mm.; the smallest, F:A.M.31925 = 179 mm. The largest metatarsus, F:A.M.33718 = 232 mm.; the smallest, F:A.M.33718G = 207 mm. (See Table III, page 172.)

(2) *C. (P.) skinneri*, n.subg. and sp., tentatively referred

From Brown and Cherry Counties, Nebraska

Eight examples from Devil's Gulch, Horse Quarry, Brown County:

Left humerus.....	F:A.M.31915	1933. This paper, <i>Fig. 18</i> .
Right and left metacarpi, 174 mm.; atlas and axis.	F:A.M.31251	1931. This paper, <i>Fig. 18</i> (right metacarpus).

[See doubtfully associated skull and mandible, page 87 (this paper, *Fig. 12*)—but limbs small, suggesting female—(metatarsi may be of two individuals).]

Right metatarsus, 196 mm.	F:A.M.31918	1933. This paper, <i>Fig. 18</i> .
Right femur, (248) mm.	F:A.M.31929	1933.
Four astragali.	F:A.M.31930A-D	1933.

One example from Plum Creek, Brown County:

Left calcaneum and astragalus. F:A.M.31917

Two examples from Valentine Quarry A, Cherry County, 1935 (tentative):

Right tibia. F:A.M.32088

Right metatarsus, 216 mm. F:A.M.31919

(3) *C. mefferdi*, n.sp., referred

From Cherry and Brown Counties, Nebraska

TENTATIVELY REFERRED.—

Left, 251 mm., and right femora.	F:A.M.32397 and 32398	From Midway Quarry, Cherry County, 1934.
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QUESTIONABLY REFERRED.—

Distal end of right femur, distal third of right tibia, right metatarsus, 223 mm., calcaneum, astragalus, tarsals, and one 1st, two 2d and two 3d phalanges. (Size large—see <i>C. granti</i> .)	F:A.M.31920	From Fairfield Creek, Brown County, 1928.
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Left metatarsus, 217 mm.	F:A.M.31928	From ?Quinn Quarry, Brown County, 1927.
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Left calcaneum.	F:A.M.31921	From head of Moore Creek, Brown County, 1930.
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Astragalus.	F:A.M.31922	From Pratt Ranch, north of Johnstown, Brown County, 1930.
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Four examples from Burge Quarry, Cherry County, 1935 (tentative):

Right metacarpus, 175 mm.	F:A.M.32907
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Right crushed metacarpus.	F:A.M.32909
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(Proportions approximating *C. granti*, F:A.M.31925.)

Two left metatarsi.	F:A.M.31924, A
Larger = 215 mm.	

(?)(3a) Var.

Tentatively referred specimen from Survey Quarry, Dawes County, 1935 (approximating, but heavier than F:A.M.31870):

EXAMPLE.—Left metacarpus, 183 mm. F:B:A.M.32858

(4) *C. dakotensis*, n.sp., referred

From Three Miles East of Rosebud, South Dakota

EXAMPLE.—Left metatarsus. A.M.22502

Very slightly larger and heavier, but near to *Procranioceras skinneri*

(5) *C. teres* (Cope)

From Santa Cruz, New Mexico

EXAMPLE.—Distal one-half F:A.M.31690 1927.
right humerus.

(Slightly smaller than that referred to *P. skinneri*.)

Right tibia. F:A.M.31691 1925.

Partial calcaneum. F:A.M.31690A From green layer.

Astragalus. F:A.M.31690B From green layer.

(6) *C. pawniensis*, n.sp., referred

From Pawnee Creek, Colorado

EXAMPLE.—Left tibia (br.). F:A.M.31650 From Quarry Hill.

(The specimen is larger than *C. teres* and about the size of *S. antilopinus*.)

Specimens from the Pawnee Creek area:

Two 1st, one 2d phalanges, four astragali, tarsus. F:A.M.31647A-H

(Possibly *Dromomeryx*, in part.)(7) (?) *C. clarendonensis*, n.sp., referred

From Clarendon, Texas

EXAMPLE.—Left metatarsus, F:A.M.32453 1935.
190 mm.

Left radius (distal portion F:A.M.33023 1936.
crushed).

Calcaneum and two astragali. F:A.M.32453A-C 1935.

II. *Rakomeryx*, NEW GENUS(1) or (2) *R. raki* (or *jorakianus*), n.sp., referred

From Barstow, California

Size close to Devil's Gulch *Procranioceras skinneri*.

EXAMPLE.—Right and distal F:A.M.31325 From bottom of Green Hills,
one-half left humerus, right 1929.
and distal end left radius, This paper, *Fig. 18* (right hu-
three carpals, right metacar- merus, radius and metacar-
pus, one 1st, one 2d and one pus).
3d phalanx.

(See associated hornless skull and mandible, page 104. This paper, *Figs. 8, 10A.*)

Six specimens from the Green Hills, 1930-31:

Left metacarpus, 188 mm.	F:A.M.31783	From Steepside Quarry, 1936.
Left metatarsus, 214 mm. (Slightly larger than <i>S. antilopinus</i> .)	F:A.M.31830	This paper, <i>Fig. 18</i> .
Right metatarsus and crushed right tibia of elon- gate proportions.	F:A.M.31828	From quarry above camp.
(Metatarsus slender, approximate length of F:A.M.31830.)		
Right partial tarsus, and metatarsus.	F:A.M.31331	From Deep Quarry.
Two partial 1st phalanges.	F:A.M.31830A	
Astragalus.	F:A.M.31831	

(4) *R. species*

From Virgin Valley, Nevada

Dromomeryx, species *a*, near *borealis* (COPE), MERRIAM, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 280, Figs. 60*a*, *b*.

REFERRED.—Distal portion U.C.19417 Figured by Merriam, 1911,
left humerus, left radius and Figs. 60*a*, *b*.
ulna, left metacarpus (br.),
two 1st, two 2d and one 3d
phalanges.

Specimen apparently of large size. John C. Merriam (1911, p. 282) observes: "In the limb figured (Fig. 60*a*) a section of the middle of the bone [metacarpus] was missing... Without considering the missing fragment the length of this bone is greater and the form more slender than that of the anterior metapodial figured by Douglass." (*Dromomeryx borealis*.) (See measurement table.)

(5) *R. gazini*, n.sp., referred

From Oregon

EXAMPLE.—Distal one-third A.M.8204X From Cottonwood Creek,
left tibia, and astragalus. 1879.
(Approximating *D. whitfordi* size.)

III. *Dromomeryx* DOUGLASS(1) *D. borealis* (Cope), referred

From Montana

(See Douglass, 1909, Ann. Carn. Mus., V, p. 465, Pl. LX, Figs. 1-4.)

Elements associated with partial skull:

Distal two-thirds both humeri, both radii, left and proximal half right ulna, left carpus and four right carpals, both metacarpi, right tibia, distal one-fourth right calcaneum, astragalus and tarsals, proximal two-thirds right metatarsus, four 1st, three 2d and three 3d phalanges, part of atlas, and six cervical and four dorsal vertebrae.

C.M.1542

Figured by Douglass, 1909, Pl. lx, Figs. 1, 2 (left forelimb and manus); Fig. 4 (right tibia); this paper, Fig. 17 (left radius and ulna, right metacarpus).

(The tibia is of the same length, but, like the partial metatarsus, is slightly heavier than the same elements of *Dromomeryx whitfordi* from Snake Creek. The partial humerus and the radius are longer and heavier, and the metacarpus shorter and slenderer, compared to C.M.827.)

Elements associated with skull and ramus:

Right humerus, radius and metacarpus, part of pelvis and sacrum, five cervical and five lumbar vertebrae.

C.M.827

Figured by Douglass, 1909, Pl. lx, Fig. 3 (humerus).

(2) *D. pawniensis*, n.sp., referred

From Pawnee Creek, Colorado

Partial metatarsus slightly larger than Nebraska specimen.

EXAMPLE.—

Three specimens from 6 miles N.E. of Pawnee Buttes, 1901:

Distal one-third right metatarsus. A.M.9450A

(Approximating *D. borealis*.)

Calcaneum and astragalus. A.M.9450B and C

(3) *D. whitfordi* Sinclair, referred

From Sinclair and Antelope Draws, Sioux County, Nebraska, 1932-35

EXAMPLE.—

Right metacarpus, 210 mm.

F:A.M.33001

From A.D. (Echo Quarry).

Left femur.

F:A.M.31876

From W.S.D.

Two complete and distal two-thirds portion of right tibiae.

F:A.M.31877-9

From E.S.D.

Right and left immature tibiae.

F:A.M.31880
31874

From W.S.D., A.D.

Right metatarsus, 235 mm.	F:A.M.31881	From E.S.D. This paper, <i>Fig. 17</i> .
Distal end of metatarsus.	F:A.M.31874A	From A.D.
Eleven astragali.	F:A.M.31882A-K	
One calcaneum.	F:A.M.31883	From W.S.D.

Note considerably smaller-sized elements here referred to *Cranioceras unicornis*—may in part represent a small female of the above.

(?) *Dromomeryx whitfordi*, Var.

From Observation Quarry, Dawes County, Nebraska, 1936

EXAMPLE.—

Distal portion right humerus. F:B:A.M.33774A

Right metacarpus (length 233 mm.; Size Group I). F:B:A.M.33756

(Approximating *Yumaceras*, Col.M.218.)

Right metacarpus (length 223 mm.; Size Group II). F:B:A.M.33772

(Question reference—much smaller than Observation Quarry F:B:A.M.33756 and slightly larger than Echo Quarry F:A.M.33001. May represent *Matthomeryx*.)

Left tibia (crushed). F:B:A.M.33774

IIIA. *Subdromomeryx*, NEW SUBGENUS

(4) *S. antilopinus* (Scott)

From Montana

Metacarpus slender and slightly longer than Devil's Gulch *Procranioceras* referred; moderately larger than Barstow hornless *Rakomeryx* elements, F:A.M.31325.

EXAMPLE.—Distal one-fourth right and partial left humerus, partial right radius, left radius and partial ulna, right and distal four-fifths left metacarpus, partial right and left femur, distal four-fifths right and proximal one-third left tibia, right calcaneum, astragalus and tarsals, partial right metatarsus, three vertebræ, etc. fragments.	P.U.10401	Figured by Scott, 1895, Pl. VI, Figs. 49, 51; this paper, <i>Fig. 18</i> (left radius and right metacarpus).
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(See apparently associated cranium, page 123. This paper, *Figs. 10, 14A*.)

QUESTIONABLY REFERRED.—

Distal one-third right radius. A.M.8132A

(4a) *S. scotti*, n.subg. and sp. (questionably referred Long Quarry)

From Sioux County, Nebraska

From Greenside and Long (rare) Quarries:	F:A.M.
Two right and one left humeri.....	33010,A,B
Partial right and partial left humerus.....	33010C,D
Distal half right humerus (Long Quarry).....	33010E
Right and left radii (32014, Long Quarry).....	32014, 33011
Left (165 mm.) and two right metacarpi.....	33012,A,B
Two right metacarpi (heavier than above and C [154 mm.] slightly shorter).....	33012C,D
Two left femora.....	33013,A
Three left tibiæ.....	33014,A,B
Right tibia (heavier than above).....	33014C
Two right and one left (187 mm.) metatarsi.....	31947, 33015, 32830
One right and two left (B = 170 mm.) metatarsi (smaller than above).....	33015A,B,C

IV. *Bouromeryx*, NEW SUBGENUS

(The questionably allocated limbs are larger and heavier and the mandibular rami are smaller than in the case of *S. scotti*.)

(1b) *B. nebrascensis*, n.sp., referred

From Camp Site, Echo Quarry, Sioux County, Nebraska, 1934

Distal one-third metacarpus (approximating in size <i>C. unicornis</i>).....	F:A.M. 31875A
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(1d) (?) *B. pseudonebrascensis*, n.sp., referred

From Observation Quarry, Dawes County, Nebraska, 1936

Nearly complete right humerus (crushed).....	F:B:A.M. 34009
Left radius.....	34009A
Right metacarpus.....	34010
Right metatarsus.....	34010A
Right metatarsus.....	33773

V. *Barbouromeryx*, NEW GENUS(4) *B. trigonocorneus* (Barbour and Schultz)

From Antelope Creek, Dawes County, Nebraska

GENOTYPE (in part).—Skeletal elements, including left and partial right humerus, both radii, right and part of left ulna, left metacarpus, left femur, tibia, tarsus, metatarsus, two 1st, two 2d and two 3d phalanges, ribs and etc. fragments. N.S.M.3-27-11-33 From $3\frac{1}{2}$ mi. S., $9\frac{1}{2}$ mi. W. of Hay Springs, S. side of Antelope Creek. This paper, *Fig. 25*.

(See associated partial skull and rami, page 134. This paper, *Figs. 2, 5, 7, 10, 14.*)

VA. *Probarbouromeryx*, NEW SUBGENUS(5) *P. sweeti*, n.subg. and sp., referred

From Bridgeport Quarry, Morrill County, Nebraska

Metatarsi intermediate between the longest and shortest *S. riparius* specimens.

REFERRED.—	QUARRY	N.S.M.
Distal portion of right humerus.....	1	76-25-6-35
Left metacarpus.....	2	29-27-9-33
	<i>Fig. 25A</i>	
Left metatarsus, 160 mm.....	2	36-27-9-33
	<i>Fig. 25A</i>	
Right metatarsus, 147 mm.....	2	38-27-9-33
Two right partial metatarsi.....	1	49-25-6-35 and 6-7-34
Two complete and one partial calcanea.....	1	34-, 69- and 33-25-6-35
Seven astragali.....	1	6-7-34,
	35-, 72- and 136-25-6-35	
Three 1st, one 2d and two 3d phalanges.....	1	6-7-34,
	138-, 43-, 45-, 47-25-6-35 and 6-7-34	
Smaller-sized:		
Two astragali.....	1	36- and 37-25-6-35
Two 2d and one 3d phalanges.....	1	6-7-34

VIII. *Yumaceras*, NEW GENUS(1) *Y. figginsi*, n.g. and sp., (?)referred

From Yuma County, Colorado

EXAMPLE.—Left metacarpus. Col.M.218 This paper, *Fig. 17*.
 (Length = 233 mm., versus *Dromomeryx borealis* metacarpus, 214 mm.)

REFERRED.—

Right and left astragali. Col.M.713/T

(1b) *Y. species*

From Clark County, Kansas

EXAMPLE.—Left metacarpus, F:A.M.30914 From J. Dakin Quarry, 1936.
 238 mm.

(2) *Y. falkenbachii*, n.sp., referred

From Guymon, Texas County, Oklahoma

EXAMPLE.—Two left astragali. F:A.M.32145, A

(2a) *Y. falkenbachii*, Var.

From Miami Quarry, Texas

EXAMPLE.—Metacarpus.

F:A.M.31518

1933.

The metacarpus is almost the size of the Kat Quarry specimen, F:A.M.31926; is much heavier than *Procranioceras* of Devil's Gulch or *Cranioceras* of Sioux County; and is slightly shorter and heavier than *Subdromomeryx antilopinus* type. The specimen is very much smaller than (?) *Y. figginsi* referred specimen.

IX. *Aletomeryx* LULL¹(1) *A. gracilis* Lull

From Cherry County, Nebraska

REFERRED.—Skeleton (composite).

Y.P.M. Coll.

From talus slope near the mouth of Antelope Creek, northwestern part of Cherry County, Nebraska.

Figured by Lull, 1920, Pl. I and Text-Figs.

(See skulls and jaws, and comparative measurements, page 156.)

REFERRED FROM VICINITY OF THE TYPE LOCALITY.—

Right, two left and five partial humeri.

F:A.M.32249, A; 32250, A, B; 32251, A, B

Largest, F:A.M.32249 = 116 mm.; smallest, F:A.M.32251 = ((104)) mm.

Three right, three left and three partial radii.

F:A.M.32252, A; 32253, A-C; 32254, A; 32255

Largest, F:A.M.32252 = 139 mm.; smallest, F:A.M.32255 = 121 mm.

Four right, three left and two partial metacarpi.

F:A.M.31931 (*Fig. 25A*); 32248 (*Fig. 25B*); 32256, B-D; 32257, A; 32258

Largest, F:A.M.31931 = 127 mm.; smallest, F:A.M.32258 = 115 mm.

Right, two left and one ?pair of crushed femora.

F:A.M.32259; 32260; 32261, A

Largest, F:A.M.32259 = ((138)) mm.; smallest, F:A.M.32261A = (133) mm.

Two right and two left, and one fragmental immature, tibiae.

F:A.M.32262, A; 32263, A, B

Largest, F:A.M.32262 = (174) mm.; smallest, F:A.M.32263A = 164 mm.

Seven right, seven left and five third lateral metatarsi.

F:A.M.31932 (*Fig. 25A*); 32264-8; 32269, A-C; 32270, A-C, AA; 32271, A-C

Largest, F:A.M.32264 = 141 mm.; smallest, F:A.M.32270AA = 129 mm.

Two distal portions of laterals.

F:A.M.32248A, AA

Twelve first and four third lateral phalanges.

F:A.M.32248B-M and N, P-R

Two distal portions of laterals (F:A.M.32248A, AA), two first (32248I, F) and two third lateral phalanges (32248R, P), together with metacarpus (32248) and its phalanges (32248S, T)—all unassociated—are figured, *Fig. 25B*.

¹ See (?) *Aletomeryx marslandensis*, var., N.S.M.1-11-8-36, pages 163, 186. *Fig. 25B*.

(1a) *A. marshi* (Lull), referred

From the Harrison, 3 Miles Northeast of Agate, Nebraska

Right and left distal humeri,
left and proximal right radius
and ulna, left carpus,
left metacarpus with slender
fifth metacarpal attached,
left distal two-thirds femur,
left and distal one-half right
tibia, right and left tarsi and
metatarsi, four 1st, four 2d
and two 3d phalanges, etc.
fragments.

A.M.14264

This paper, *Fig. 25A* (left
metacarpus and metatarsus).

(Associated with partial crania, A.M.14264 and 14264A, see page 160.)

As compared to *Parablastomeryx gregorii*, F:A.M.31360, from Cherry County, in *A. marshi* the metacarpus is slightly shorter versus the radius, the metatarsi slightly longer as compared to the tibiae, and the metacarpus of the same length as the metatarsus.

(1b) *A. gracilis*, Var.

From Barbour-Hemingford Quarry, Box Butte County, Nebraska, 1936

QUESTIONABLY REFERRED.—

Two right and two left metacarp.

N.S.M.23- to 26-28-7-36

Etc. foot bones.

N.S.M. Coll.

(2) *A. lugni*, n.sp., referred

From Bridgeport, Morrill County, Nebraska

REFERRED.—Two right metatarsi.

N.S.M.6- and 7-1-7-32

From Quarry 3.

(Length = 152 mm., versus 160 mm. of *Probarbouromeryx sweeti*.)(3) *A. marslandensis*, n.sp., referred

From Marsland, Box Butte County, Nebraska

REFERRED.—Two left metacarp.

N.S.M.5-18-7-34

(Length = 148-156 mm.)

Right metacarpus.

N.S.M.41-11-7-35

Right metatarsus, 169 mm.

N.S.M.5-26-6-35

Left metatarsus, 153 mm.

N.S.M.8-8-6-35

Several partial limb and numerous foot bones, N.S.M. Coll.

A skull, mandible and skeleton, N.S.M.1-11-8-36, of a female from the Middle Tertiary of Box Butte County (kindness of Professor Barbour) is of remarkable interest in witnessing the retention in this early deer of metacarpals II and V, which, though extremely slender medianly, are complete. Whether lateral metatarsals were similarly retained or represented by splints is not indicated. This new evidence suggests the possibility that the proximally broken splints of *A. gracilis* actually may represent complete lateral metacarpals. *Fig. 25B*.

X. *Sinclairiromeryx*, NEW GENUS(4a) (?) *S. riparius* (Matthew), and Var., referred

From Sheep Creek, Sioux County, Nebraska

Larger and smaller individuals are exemplified in a series of limb bones from the Sheep Creek beds, Sioux County, Nebraska. The dimensions, broadly considered, tend to approximate those of the *Barbouromerys* genotype. The metapodials are disproportionately larger (or smaller). The specimens are rather tentatively referred to *Sinclairiromeryx*, so well represented in rami, etc., from the same deposit. Certain of the larger specimens well may represent *S. sinclairi* or even *Subdromomeryx*.

EXAMPLES FROM STONEHOUSE DRAW, COLLECTED 1922-23 [A.M. NUMBERS] AND 1933-34 [F:A.M. NUMBERS].—

Larger

Left humerus, (141) mm.	F:A.M.31896	Left tibia, (196) mm.	A.M.18958J
Right humerus.	F:A.M.32013	Left tibia.	F:A.M.32017
Left radius, (165) mm.	F:A.M.32013A	Right metatarsus, (165) mm.	F:A.M.32018
Right metacarpus, (165) mm.	F:A.M.32015	Left metatarsus.	F:A.M.32018A
Right femur, (177) mm.	F:A.M.31893		

Smaller

Right humerus, head missing.	F:A.M.31890	Left femur, proximal end crushed.	F:A.M.32016
Two right radii.	F:A.M.31891, A.M.18958C	Right femur, (168) mm.	F:A.M.31894
Right radius, (140) mm.	F:A.M.31892	Right tibia, (182) mm.	A.M.18958A
Two left metacarpi.	A.M.18958G, F:A.M.32015A	Right tibia.	F:A.M.31895
Left metacarpus, (140) mm.	A.M.22477B	Two right metatarsi.	A.M.18958F, F:A.M.32018B
Right metacarpus.	A.M.18958H	Right metatarsus, (147) mm.	A.M.18958E

(4aaa) Questioned Vars. or Species

From Long, Echo and Thistle Quarries, Sioux County, Nebraska

REFERRED.—

From Long Quarry:	F:A.M.	From Thistle Quarry (smaller-tending):	F:A.M.
Right radius.	31886	Two left radii.	33016,A
Right tibia.	31888	Left metacarpus.	33017
Right metatarsus.	31887	Right and left femora (br.)	33018,A
(Length = 158 mm.)		Four left metatarsi.	33019,A-C
From Echo Quarry:			
Right femur.	31875		
Left tibia.	31889		
Distal one-half right tibia.	31889A		

(5) *S. tedi*, n.sp., referred

From Ginn Quarry, Dawes County, Nebraska, 1935

REFERRED.—Right tibia. F:B:A.M.32859

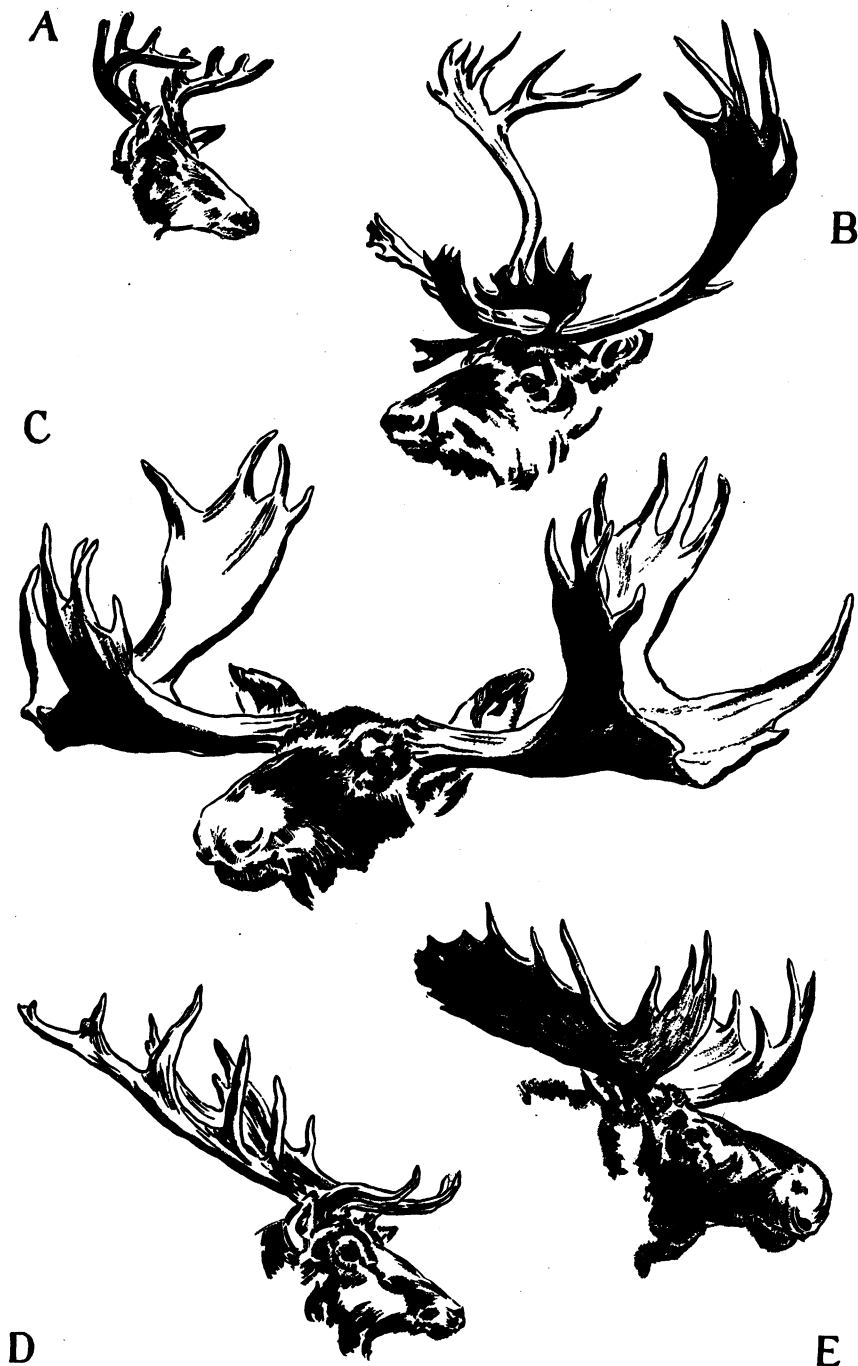


FIG. 19. Deer forms of the American Quaternary.
 Heads in flesh $\times$ approximately $\frac{1}{18}$ (c oversized). (See legend, page 195.)
 White-tail (A) *Odocoileus Rafinesque*
 Caribou (B) *Rangifer H. Smith*

Giant Elk (c)
Cervalces Scott
 Elk (D)
Cervus Linnaeus

Moose (E)
Alces Gray

DIVISION C.—CERVINI

Figures 19, 20, 20A, 20B, 21

A comprehensive comparative study of the dental and cranial characters of the living deer of the world might indicate a working classification of the same adaptable to the need of the palæontologist. The lack of a comparative osteology on the living deer is paralleled by the general absence of similar data on most mammalian groups. Probably there has been no great change in the deer since the Pleistocene and the species of today represent no more than the survivors of certain of the numerous species of that time. Our own deer of the New World, with the exception of the wapiti, have been shown by Brooke (1878) to differ from the great majority of the deer of the Old World by the retention of the distal ends of the lateral metacarpals, by the tendency of the premaxillary branches not to reach the nasals and, with the added exception of the moose, by the division of posterior nasal cavity into two distinct chambers. A casual examination of the dentitions suggests a tentative subdivision of the North American Cervini¹ between four subfamilies, the (Plesiometacarpalia) Cervinæ and the (Telemetacarpalia) Odocoilenæ, Alcenæ and Rangiferinæ. The Cervinæ (*Cervus*) with posterior nares undivided and Odocoilenæ (*Odocoileus*) with nares divided, resemble one another in moderate-proportioned premolars, open p_3 , tendency to closed anterior fossette in p_4 and moderate-lengthed diastema. The teeth differ from *Alces* (posterior nares undivided) and *Rangifer* (posterior nares divided), in which the premolars are unusually large-proportioned, the unworn premolar columns detached, the p_3 closed, the diastema long and the metacarpals shorter-proportioned. The dentition of *Rangifer* is recalled in moderate degree by that of the giraffe. Examples of the mandibular tooth series of Recent *Alces*, *Cervus*, *Rangifer* and *Odocoileus* are illustrated in Figure 20A.

Representatives of the modern deer (Cervini) generally have been considered not to have appeared in North America previous to the Pleistocene; therefore, the suggestion of the occurrence in the Uppermost Pliocene of Eden, southern California, of a Cervine is of unusual interest. The Eden evidence is presented below, and at the same time occasion is taken to describe briefly, enumerate and partially figure certain new Cervines (Cervini) from the Pleistocene of (B) North America and of (C) Ecuador.

¹ See footnote 2, next page.

TABLE IV
METACARPAL LENGTH RELATIVE TO SKULL LENGTH IN CERTAIN OF THE CERVINI
(Skull length measured from back of condyles to front of premaxillæ)

<i>Alces americana shirasi</i>	♂	A.M.(M.)100348	Wyoming	$\frac{310}{530} = 59\%^1$
“ “ “	♀	“ 100349	“	$\frac{307}{523} = 59\%$
<i>Rangifer montanus</i> ...	♂	“ 3760	Maine	$\frac{222}{372} = 60\%$
<i>Mazama cita sanctæ-</i> <i>martæ</i>	♀	“ 23481	Colombia	$\frac{103}{160} = 64\%$
<i>Mazama nemorivaga</i> ...	♂	“ 42403	British Guiana	$\frac{112}{167} = 67\%$
<i>Cervus canadensis</i>	♂	“ 35655	N. Y. Zoo	$\frac{292}{435} = 67\%$
“ “	♀	“ 35619	Central Park Zoo	$\frac{296}{443} = 67\%$
<i>Cervus elaphus</i>	♂	“ 14090	N. Y. Zoo	$\frac{185}{268} = 69\%$
“ “	♀	“ 14444	“	$\frac{233}{337} = 69\%$
<i>Odocoileus columbianus</i> .	♀	“ 35733	“	$\frac{182}{262} = 69\%$
<i>Odocoileus virginianus</i> .	♂	“ 8363	“	$\frac{181}{237} = 76\%$
“ “ ...	♀	“ 14085	Central Park Zoo	$\frac{190}{248} = 77\%$

¹Length metacarpus
Length skull

Parablastomeryx gregorii, 151/165 = 91%; *Moschus*, 93.5/121 = 77%; *Muntiacus*, 86/155 = 55%; *Tragulus*, 37/86.5 = 44%.

² Three of the North American genera occur as well in the eastern hemisphere: (Telemetacarpalia) *Rangifer*, *Alces* and (Plesiometacarpalia) *Cervus*. Of the four remaining Eurasiatic genera, *Capreolus* and the hornless *Hydrelaphus* tend to parallel *Rangifer*, and *Cervulus* and the hornless *Elaphodus* to parallel *Cervus* in metacarpal characters. The condition of the metacarpals in the hornless *Moschini* is as in *Rangifer*. The widely differentiated forms of *Cervus* are divided by Lydekker between Elaphine (typical), Sikine, Damine, Rusine, Rucervine and Elaphurine subdivisions.

GARROD, A. H., 1877, Proc. Zool. Soc. London; BROOKE, V., 1878, *ibid.*; LYDEKKER, R., 1898, The Deer of All Lands.

(A) (?)CERVINI FROM THE UPPERMOST TERTIARY

Subfamily 7.—*Cervinæ*XI. *PROCOILEUS*, NEW SUBGENUS

Total available specimens, 3

Figure 20 (in part)

(1) *Procoileus edensis*, new subgenus and species

From Eden Beds, Southern California

A ramal fragment with p_2 - m_1 from the Eden Beds is practically unique in pointing to the possibility of the presence of a true Cervine in America as early as the Uppermost Pliocene. The premolars are compressed and high-crowned; the p_2 is proportionately small, the p_3 - p_3 moderately tall, the p_4 with formed anterior fossette; and the m_1 moderate-crowned and having a well-developed median column. The compression of the premolars and the large size of p_4 versus the m_1 (worn) are indicative of a Cervine rather than a Dromomerycine form. The p_3 and m_1 somewhat approximate in size, but p_4 is larger and closed, and p_2 smaller than in a specimen of *Dama*.

A broken premolar and an astragalus from the same Eden Beds, which the writer in 1921 (Univ. Cal. Pub. Bull. Dept. Geol., XII, p. 378) figured under "Cervid species," are referred tentatively to the species. The Eden Beds (1933, Bull. Amer. Mus. Nat. Hist., LIX, p. 516) afford the best so-far-known representation of the mammals of the American Uppermost Pliocene.

SUBGENOTYPE.—Portion of
right ramus with p_2 - m_1 (br.).
(M+)

F:A.M.31772

From No. 3 Stratum, Marble
Canyon, November 28,
1922.

This paper, *Fig. 20*.

TENTATIVELY REFERRED.—

Portion of a premolar.

U.C.24036

Figured by Frick, 1921, Text-
Fig. 95.

Inferior half of astragalus.

U.C.23779

Figured by Frick, 1921, Text-
Fig. 96.

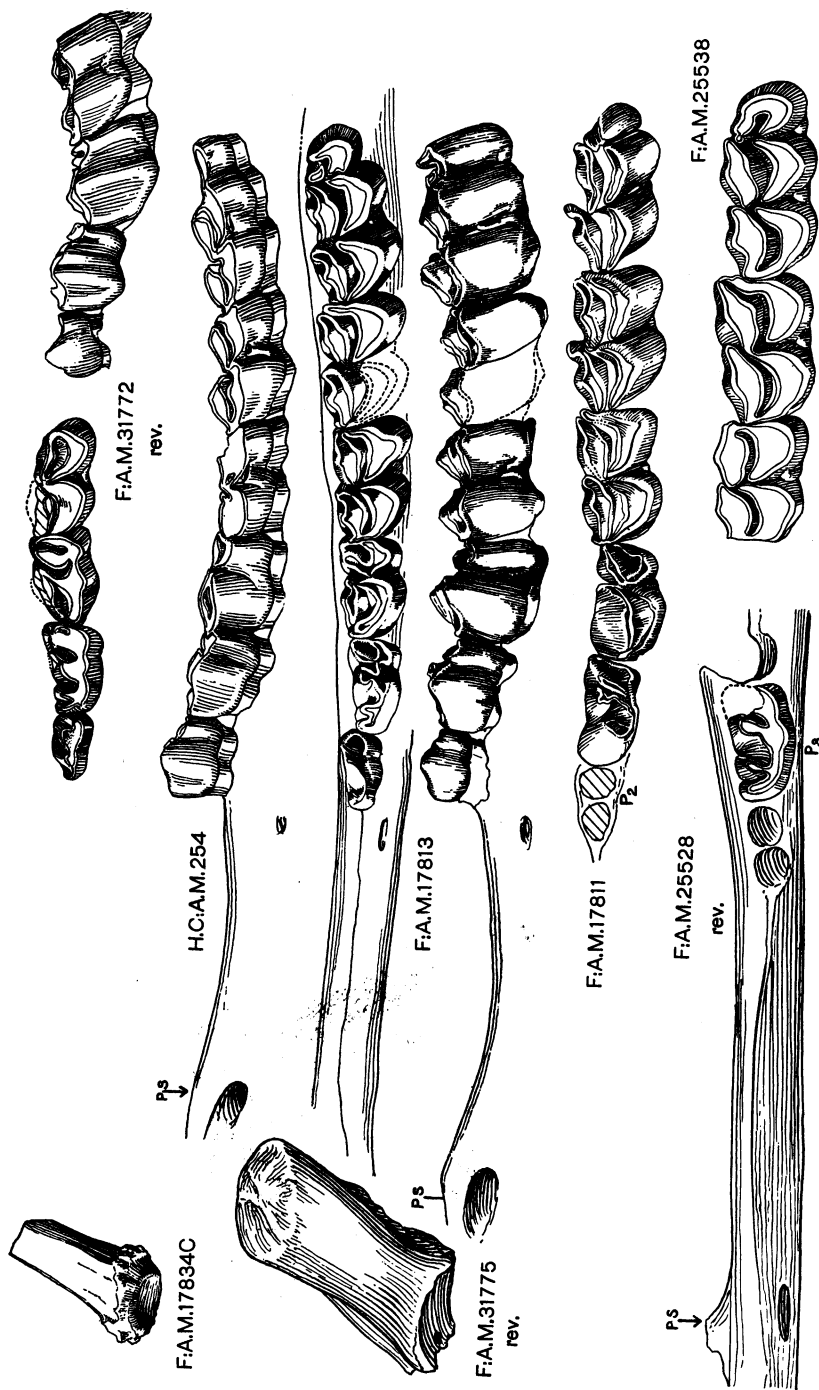


FIG. 20. *Procoileus*, n. subg., subgenotype, from the Uppermost Pliocene of Eden, California (F.A.M. 31772), and types of three *Odocoileus* species, from the Pleistocene of California and Nebraska.
Dentitions $\times 1$, antler base and horn-pedicle $\times 1$. (See legend, page 195.)

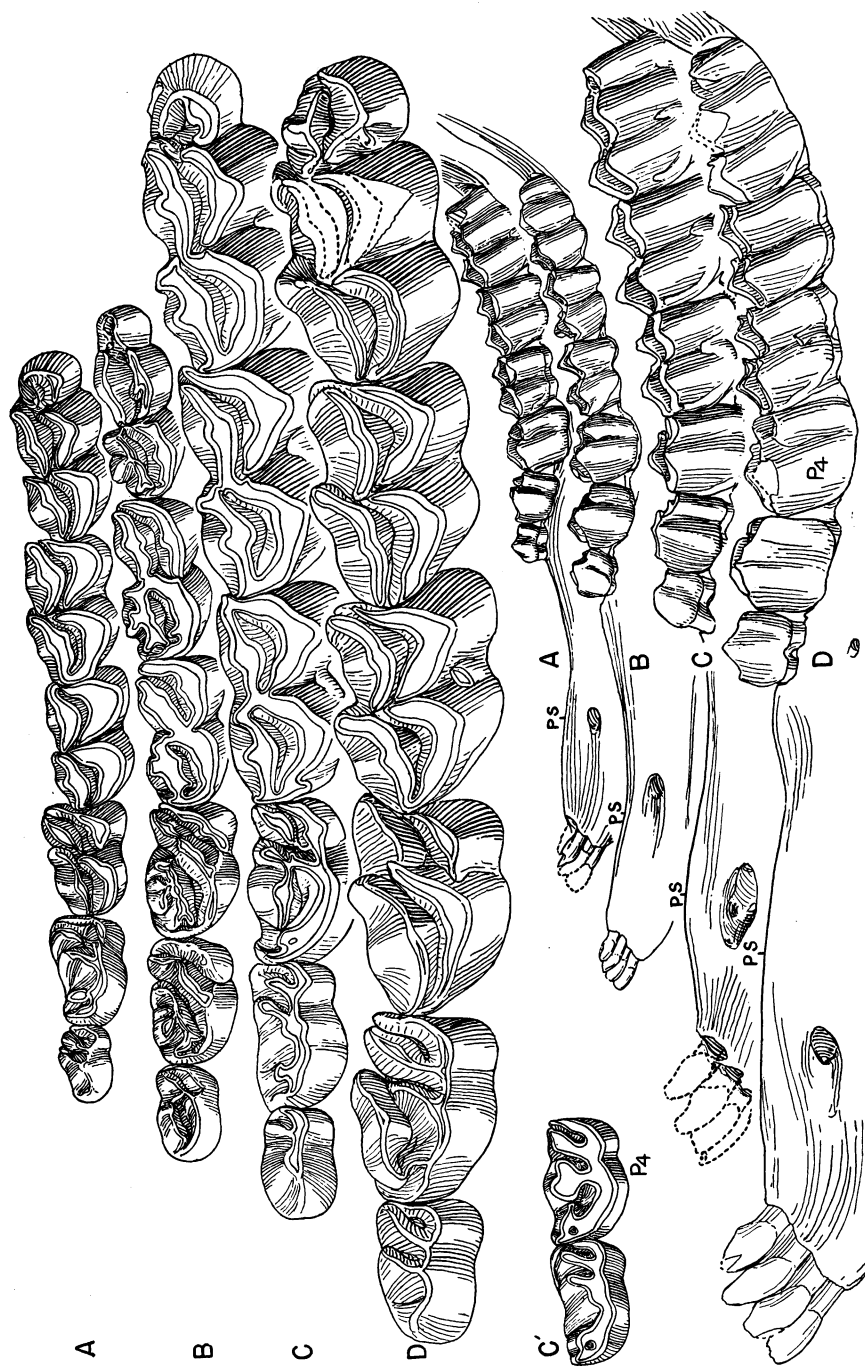


FIG. 20A. *Odocoileus Rafinesque* (A), *Rangifer* H. Smith (B), *Cervus* Linnaeus (C and C') and *Alces* Gray (D), of Recent North America, mandibular dentitions compared.
Lateral views $\times \frac{1}{2}$; occlusal $\times 1$. (See legend, page 195.)

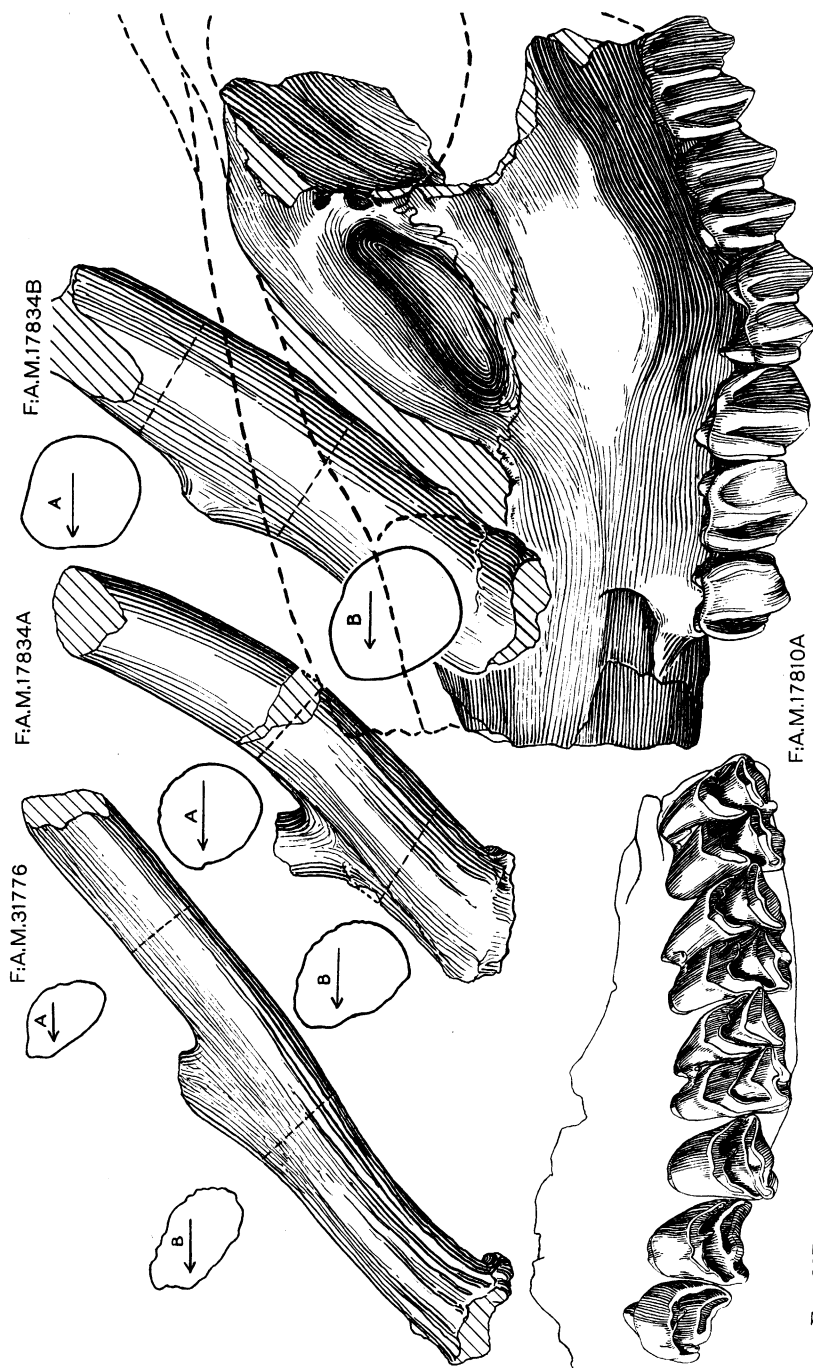


FIG. 20B. *Cervus aguanga*, n.sp., type (F.A.M. 31776), and *Odocoileus cascensis*, n.sp., ref., from the Pleistocene of California. Skull and dentitions $\times 1$, antlers $\times \frac{1}{2}$. (See legend, page 195.)

FIG. 19. Details of Cervini heads in flesh:

- (A) *Odocoileus virginianus borealis* (Miller)
 - (B) *Rangifer osborni* Allen
 - (C) *Cervalces alaskensis*, n.sp., from the Pleistocene of Alaska (reconstructed after *C. scotti* type)
 - (D) *Cervus alaskensis*, n.sp., from the Pleistocene of Alaska (length on curve 128 cm.)
 - (E) *Alces americana americana* (Clinton)
- A, B and E based on specimens shot by author.
 A, from Essex County, New York, 1899, and
 B and E, from Cassiar Province, B. C., 1910.

FIGS. 20, 20A AND 20B. Cervini from the Uppermost Pliocene, Pleistocene and Recent of North America.

Dentitions $\times 1$ (excepting lateral views, Fig. 20A, $\times \frac{1}{2}$); antlers, antler base and horn-pedicle $\times \frac{1}{2}$. A, B, cross sections of antlers; PS, posterior border symphysis.

FIG. 20. F:A.M.31772, *Procoileus edensis*, n.subg. and sp., subgenotype, rev., from the Uppermost Pliocene, Eden, California.

(See page 191.)

H.C.-A.M.254, *Odocoileus cooki*, n.sp., type, from the Pleistocene, Sioux County, Nebraska.

(See page 202.)

F:A.M.17813 and 17811, *Odocoileus cascensis*, n.sp., type and ref., from El Casco, California.

(See page 201.)

F:A.M.25528 (rev.) and 25538, *Odocoileus sheridanus*, n.sp., type and ref., from Hay Springs, Sheridan County, Nebraska.

(See page 200.)

F:A.M.17834C and 31775 (rev.), *Odocoileus cascensis*, n.sp., ref., respectively, base of immature antler and horn-pedicle, from El Casco, California.

(See page 201.)

FIG. 20A. Details of Recent Cervini mandibular dentitions:

PS, posterior border symphysis.

- (A) *Odocoileus virginianus* (Zimmermann), ♂, A.M.(M.)13792.
- (B) *Rangifer granti* Allen, ♂, A.M.(M.)73698, from Alaska.
- (C) *Cervus roosevelti* Merriam, ♀, A.M.(M.)24153, from British Columbia.
- (C') *Cervus elaphus* Linnæus, ♀, A.M.(M.)16866, from Europe (for comparison).
- (D) *Alces americana* (Clinton), ♀, A.M.(M.)8049, from Minnesota.

FIG. 20B. F:A.M.31776, *Cervus aguanga*, n.sp., type, from southern California.

(See page 200.)

F:A.M.17834A, B, and 17810A, *Odocoileus cascensis*, n.sp., ref., from El Casco, California.

(See page 201.)

(B) CERVINI FROM THE PLEISTOCENE OF NORTH AMERICA

Subfamily 7.—*Cervinae* (cont.)XII. *CERVUS* LINNÆUSSubfamily 8.—*Odocoilena*XIII. *ODOCOILEUS* RAFINESQUESubfamily 9.—*Alcenæ*XIV. *CERVALCES* SCOTTXV. *ALCES* GRAYSubfamily 9a.—*Rangiferina*XVI. *RANGIFER* H. SMITH

Figures 19, 20A, 20B and (in part) 20, 25B

Statement

Species of *Odocoileus* Rafinesque (1832), *Cervus* Erxleben (1777), *Alces* Gray (1821), *Cervalces* Scott (1885) and *Rangifer* H. Smith (1827) have been reported from North American Pleistocene deposits. Moreover, *Cervus*, *Alces*, *Cervalces* and *Rangifer* are present in our recent collections from the deeply frozen deposits that overlie the auriferous gravels of the Fairbanks area, Alaska.¹ *Cervalces* has hitherto been unrecognized in the far north.

The opportunity is taken to record and figure several undescribed Cervines from the Nebraskan, New Mexican and Californian Quaternary, the forms being tentatively referred to Recent genera under several separate species, and at the same time to mention briefly the new Alaskan *Cervalces*.

The largest of the new Cervine species approached a small wapiti in size. It is exemplified in a metatarsus and partial antler collected by Joseph Rak at Las Cruces, New Mexico. As seen in the metatarsus, the

¹ Note Frick (1930, Natural History, XXX, No. 1, pp. 70-80), "Alaska's Frozen Fauna"; also Frick (1933, Bull. Amer. Mus. Nat. Hist., LIX, Art. IX, pp. 631-633), material from Fairbanks, Alaska, assigned to *Mastodon americanus alaskensis* Nobis and *Elephas primigenius alaskensis* Osborn.

stature of the species was intermediate between the wapiti and the European red deer. The form may be known as *Cervus lascrucensis*.

A deciduous antler of peculiar character, secured by Guy E. Hazen from an outlier of the San Timoteo Pleistocene, seems to be indicative of an unknown deer of *Odocoileus hemionus* size. The specimen, which is much compressed laterally and extensively and deeply veined, does not appear referable to any Recent species. It is made the type of a new species tentatively referred to *Cervus*, *C. aguangæ*.

Two mandibular specimens differ from *O. virginianus* in the greater elongation of the diastema. An even more elongate diastema was reported by Cope for the *O. virginianus*-sized ramus of his type of *Cariacus dolichopsis* from the Pleistocene of Indiana.¹ The first of the two new specimens is important in, for the first time, adding a Cervine to the Hay Springs-Sheridan fauna. This Sheridan species considerably exceeds in size any Recent *Odocoileus*. The top of a large cranium bearing portions of the horns, Nebraska State Museum Collection, from the gravel deposits of northern Nebraska, may belong to the Hay Springs form. The second and more average-sized of the mandibular specimens is from El Casco, California, and of a species well represented in both horns and rami. It is probable that this form is closely allied to or identical with that described in 1921 from the not far distant Bautista deposit. It was observed that the metapodials in the case of the latter were slenderer and longer-proportioned than in Recent species. Collections made by the late Joseph Rak in the vicinity of the El Casco locality include *Megalonyx*, *Tapirus*, *Equus*, (?)*Tetrameryx*, etc. A variety of the El Casco deer may be represented by a series of horns collected in Imperial County, California, by Guy E. Hazen in the spring of 1936.

A ramus from the Pleistocene in the vicinity of Agate, Nebraska (H.C.-A.M.254), which contrasts with the above in the shortness of the diastema and heaviness of the p_2 , is taken as the type of a new species and tentatively referred to *Odocoileus*, *O. cooki*, n.sp.

Oliver P. Hay (1924) indicates the wide distribution in the Pleistocene of Cervid forms. Possibly when all the evidence is restudied a number of genera or subgenera will be found to be represented in addition to those now recognized. *Sangamona* Hay (1920), genotypic species *S. fugitiva*, type molar from Tennessee, is said to have been larger than *Odocoileus*.

¹ The type left ramus of (?)*Odocoileus dolichopsis* (Cope), from Vandenburg County, Indiana, according to Cope, was of the size of *O. virginianus*, but the diastema was an inch longer and the tooth-line shorter. (*Cariacus dolichopsis* Cope, 1878, Bull. U. S. Geol. and Geog. Surv. Terr., IV, p. 379; Amer. Nat., XII, p. 189.)

While a majority of the Quaternary Cervid remains have been identified with the existing species, a number of new forms have been described:

O. virginianus (fossilis) (Leidy, 1854), from Mississippi; *O. whitneyi* (Allen, 1876), from Wisconsin; *C. lucasi* Hay (1927), from Idaho; *O. ensifer* (Cope) (1889), from Whitman County, Washington; *O. lævicornis* (Cope) (1896), from Port Kennedy Cave, Pennsylvania; *O. sellardsiæ* Hay (1917), from Florida¹; *Rangifer muscatinensis* Leidy (1879), from Iowa; *Alces brevitrabalis* Cope (1889) and *A. semipalmatus* Cope (1889), from Whitman County, Washington; *A. shineki* Hay (1914), from Iowa; *A. runnymedensis* Hay (1923), from South Carolina.

The evidence as to the Alaskan *Cervalces* was secured in the vicinity of Fairbanks by John B. Dorsh of the joint American Museum-Alaska University expedition working in coöperation with the U. S. Smelting, Refining and Mining Company. The evidence consists in proximal portions of two antlers which are of the right and left sides, respectively, and may represent one individual. The right antler is the better preserved and is selected as the type. The distance from the burr to the beginning of the palmation is 25% greater than in the largest previously known specimen, that from Toronto, and is over twice the length of that of the beautiful Princeton genotype (see measurement table, page 203). A fine *Cervalces*-like antler from Nebraska has been called to the attention of the writer by Professor Erwin H. Barbour. In the Nebraskan horn more of the palmation is preserved than in the Alaskan remains, but as the proximal portion of the shaft unfortunately is broken, a comparison of the length of beam is impossible. The two new occurrences result in the giant genus now being known from Kentucky, New Jersey, Iowa, Nebraska, Ontario and Alaska.

Rangifer,² like *Alces*, has been cited (Hay, 1923, '24, '27) from Quaternary deposits in the eastern, central and western regions of the United States, Ontario and Grinnell Land (*Rangifer* only). Both genera are well represented in the collections from the Fairbanks area, Alaska (to be reported on later).

Pleistocene-Recent Cervini of North America are here considered as of four subfamilies: Cervinæ (*Cervus*), Odocoilenæ (*Odocoileus* and *Eucervus*), Alcenæ (*Cervalces* and *Alces*) and Rangiferinæ (*Rangifer*).

¹The generic reference of the peculiarly interesting Florida species, *Blastocerus extraneus* Simpson (1928), is yet to be confirmed. In the type, right p₂-m₂, A.M.23457, the /ps are relatively small, and p₄ "open."

²C. B. Schultz and E. B. Howard (1935, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 287, Pl. XIII, Figs. 1-2; Pl. XIV, Fig. 7) tentatively refer to *Rangifer* as a species, *R. fricki*, an extremely interesting dentition of a large Caribou-like Cervid from Burnet Cave, New Mexico. The teeth, unfortunately, are much worn. The fosses of p₂-p₄ apparently were formed. The specimen is characterized by the large proportionate size of the premolars and the length of the diastema anterior to the same.

Summary of New North American Pleistocene Species

The evidence as to the six new North American Pleistocene species of *Cervus*, *Cervalces* and *Odocoileus* is listed in the following pages:

XII. *Cervus* Linnæus.

- (1) *Cervus lascrucensis*, n.sp., from Las Cruces, New Mexico.

TYPE.—Partial antler, F:A.M.31741.

- (2) *Cervus aguangæ*, n.sp., from Aguanga, southern California.

TYPE.—Right horn-core, F:A.M.31776. This paper, *Fig. 20B*.

XIII. *Odocoileus* Rafinesque.

- (1) *Odocoileus sheridanus*, n.sp., from Hay Springs, Sheridan County, Nebraska; and Var.

TYPE.—Right ramal fragment, F:A.M.25528. This paper, *Fig. 20*.

EXAMPLE.—Posterior cranium, N.S.M.1-11-27.

- (2) *Odocoileus cascensis*, n.sp., from El Casco, California; and Vars.

TYPE.—Left ramus, F:A.M.17813. This paper, *Fig. 20*.

EXAMPLE.—Partial antler, U.C.23419.

- (3) *Odocoileus cooki*, n.sp., from Agate, Sioux County, Nebraska.

TYPE.—Left ramus, H.C.-A.M.254. This paper, *Fig. 20*.

XIV. *Cervalces* Scott.

- (1) *Cervalces alaskensis*, n.sp., from Fairbanks area, Alaska.

TYPE.—Fragment of a right antler, A.C.-F:A.M.30496.

Detailed Lists of New Types, Referred Specimens, and Synonymy

Cervus, total available listed specimens, 6; *Odocoileus*, 37; *Cervalces*, 5

XII. CERVUS LINNÆUS

Head in Flesh, Figure 19d

- (1) *Cervus lascrucensis*, new species

From the Pleistocene of Las Cruces, New Mexico

TYPE.—Partial antler.

F:A.M.31741

Joseph Rak, collector, 1929.

REFERRED.—

Left metatarsus.

F:A.M.31742 . 1929.

Length = 242 mm. (Intermediate in size between *Cervus elaphus* and *Alces americana*.)

(2) *Cervus aguangæ*, new species

From Southern California

The form is represented by a peculiarly laterally compressed and very unusually deeply and extensively veined horn. The horn in some ways is more suggestive of *Rangifer* or *Dama* than of *Odocoileus*.

TYPE.—Right horn-core, broken distally.

F:A.M.31776

From the vicinity of Aguanga,
Section 15, 1933.
This paper, *Fig. 20B*.

REFERRED FROM THE SAME LOCALITY.—

Detached base of antler,
prong, and base of immature
antler.

F:A.M.31776A-C

1933.

XIII. *ODOCOILEUS* RAFINESQUE

Head in Flesh, Figure 19A

(1) *Odocoileus sheridanus*, new species

From Hay Springs, Sheridan County, Nebraska

TYPE.—Right fragment with
posterior symphysis, p_3 (br.),
alveoli of p_2 and p_4 . (M+)

F:A.M.25528

Charles Falkenbach, collec-
tor, 1928.
This paper, *Fig. 20*.

REFERRED.—

Left fragment with m_1 - m_3 .
(M+)

F:A.M.25538

1929.

This paper, *Fig. 20*.Two detached m_2 s. (w)

Teeth considerably larger, diastema actually shorter than in F:A.M.17813 from El Casco. p_3 smaller, diastema apparently slightly longer-proportioned than in European red deer, A.M.(M.)16866, female.

(1a) (?) Variety

From Pleistocene Gravels, Northern Nebraska

EXAMPLE.—Posterior part of N.S.M.1-11-27 Lyman Richey Gravel Company, Meadow, Nebraska.
 cranium with portion of
 horns.

Size approximating largest of El Casco specimens, F:A.M.17834B, in which the brow tine is located nearer the base.

(2) *Odocoileus cascensis*, new species

From El Casco, California

TYPE.—Left ramus with dia- F:A.M.17813 Joseph Rak, collector.
 stema and p_2 - m_3 . (M) This paper, Fig. 20.

REFERRED.—

Right fragment with p_4 - F:A.M.17814
 m_3 . (M)
 Fragment with dp_2 - dp_3 . F:A.M.17820A

Slightly larger:

Left ramus, p_2 - m_3 . (M) F:A.M.17811 This paper, Fig. 20.
 Left fragment, p_2 - m_3 . (w+) F:A.M.17812
 Palate with p^2 - m^3 . F:A.M.17810A This paper, Fig. 20B.
 Detached maxillary and
 mandibular teeth.

Four specimens of antlers:

Portion of right antler. F:A.M.17834A This paper, Fig. 20B.
 Portion of right antler. F:A.M.17834B This paper, Fig. 20B.
 Portion of frontal with F:A.M.31775 From Aguanga horizon, Sec-
 bases of both antlers. tion 15, 1933.
 This paper, Fig. 20.
 Base of immature antler. F:A.M.17834C From El Casco.
 This paper, Fig. 20.
 Three distal ends of hu- F:A.M.31779, From El Casco.
 meri A and B

(2a) Variety

From Bautista, Southern California

Odocoileus ?two or more species, FRICK, 1921, Univ. Cal. Pub. Bull. Dept. Geol., XII, p. 296, Text-Figs. 5, 6, 9-12.

EXAMPLE.—Partial antler.

U.C.23419

Figured by Frick, 1921, Text-Fig. 6.

REFERRED.—

Specimens, including fragment of ramus and a series of associated limb elements, figured, 1921, Text-Figs. 5 and 9-12.

(2b) Variety

From Carrizo Creek, Southern California

EXAMPLE.—Right antler, posterior point missing.

F:A.M.31862

Collected spring, 1936, by Guy E. Hazen.

(The anterior branch is single-pointed.)

REFERRED.—

Two large and one small antler base. F:A.M.31863,A,B

Thirteen portions of antlers of smaller and larger individuals, F:A.M. Coll.

Fragments of dentitions and limbs, F:A.M. Coll.

[Limb proportions approximate *Odocoileus hemionus*, A.M.(M.)122667, from Alberta, Canada.]

(3) *Odocoileus cooki*, new species

From the Pleistocene, Vicinity of Agate, Sioux County, Nebraska

TYPE.—Left ramus with diastema, p_1 - m_1 .

H.C.-A.M.254

This paper, Fig. 20.

Premolars, particularly p_3 , and molars a little larger, but diastema shorter than in Recent *O. virginianus*, A.M.(M.)164. A proportionate heaviness of the p_2 is seen in an Ecuadorian fossil.

XIV. CERVALCES SCOTT

Head in Flesh, Figure 19c

Evidence witnessing the former occurrence in Alaska of the extinct giant elk, *Cervalces*, is of much interest. Species of the genus have been described from New Jersey, genotypic species *Cervalces scotti*; from Toronto, Ontario, *C. borealis*; and from Iowa, *C. roosevelti*. Remains have been referred to the last from Illinois and Oklahoma, and to indeterminate species¹ from Pennsylvania, Virginia, Kentucky and Missouri. The Alaska specimens indicate a considerably larger individual than any heretofore known. The (1) Alaska, (2) Ontario, (3) Iowa and (4) genotypic New Jersey evidence is as follows:

(1) *Cervalces alaskensis*, new species

From Fairbanks Area, Alaska

TYPE.—Beam, burr and initial palmation of right antler, and possibly of same indi- vidual—	A.C.-F:A.M. 30496	Secured by John B. Dorsh, 1933.
Similar portion of left antler.	A.C.-F:A.M. 30497	1933.

MEASUREMENTS

	<i>C. alaskensis</i> , n.sp., type A.C.- F:A.M. 30496	<i>C. borealis</i> Bensley, 1913 Univ. Toronto 20176	<i>C. roosevelti</i> Hay, 1913 Univ. Iowa Coll.	<i>C. scotti</i> (Lydekker), 1898, Prince- ton Univ. Coll.
Burr to palmation	430 mm.	330 mm.	300 mm.	180 mm.
Diameter of shaft	70	60	55	54

(2) *Cervalces borealis* Bensley

From Toronto, Ontario

Cervalces borealis BENSLEY, 1913, Univ. Toronto Studies, Geol. Ser., No. 8, p. 1, Text-Fig., p. 2. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 269.

¹ The references as to indeterminate species from Pennsylvania, Virginia, Kentucky and Missouri are: Frankstown Cave, Pennsylvania, Peterson (1926); Saltville, Virginia, Peterson (1917); Bigbone Lick, Kentucky, Hay (1923); and Kimmawick, Missouri, Koch (1840), Hay (1924).

TYPE.—Right antler.	Univ. Toronto 20176	From the Toronto interglacial. Figured by Bensley, 1913, Text-Fig., p. 2.
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(3) *Cervalces roosevelti* Hay¹

From Iowa

Cervalces roosevelti HAY, 1913, Proc. Biol. Soc. Wash., XXVI, p. 5, Fig. 1; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 267.

TYPE.—Partial right antler and skull.	Univ. Iowa Coll.	From near Denison, Crawford County, Iowa. Figured by Hay, 1913, Fig. 1.
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(4) *Cervalces scotti* (Lydekker), genotypic species

From New Jersey

Cervus americanus HARLAN, 1825, Fauna Americana, p. 245.

Cervalces americanus SCOTT, 1885, Science, V, p. 420, figs.; Proc. Acad. Nat. Sci. Phila., XXXVII, p. 181, Pl. II, Text-Figs. 2, 5 [and 7, tarsus].

Alces scotti LYDEKKER, 1898, The Deer of All Lands, p. 60, Fig. 14 (after Scott).

Cervalces scotti (LYDEKKER), SCOTT, 1913, A History of Land Mammals in the Western Hemisphere, p. 195, Fig. 113(3), pp. 208, 209, Fig. 117. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 261, Text-Figs. 91, 92 (after Scott).

GENOTYPE.—Complete skeleton save for right scapula and humerus and a few caudal vertebrae, a few podials and ribs.	Princeton Univ. Coll.	From (Rev. A. A. Haines) Mt. Hermon, near Delaware Station, New Jersey. Figured by Scott, 1885, Pl. II, Text-Figs. 2, 5 [and 7, tarsus], and 1913, Figs. 113(3) and 117. Figured by Lydekker, 1898, Fig. 14 (after Scott).
--	--------------------------	--

Nasals said to be longer, palmation smaller and more distinctly divided into an anterior and posterior branch, than moose; horn-pedicles longer than in *Alces* and legs exceedingly long with distal ends of laterals present.

¹ Hay (1923) records under *C. roosevelti* referred, teeth from Oklahoma and bones from Joliet, Illinois.

(c) CERVINI FROM THE QUATERNARY OF SOUTH AMERICA

Subfamilies 8 and 9a.—*Odocoilenæ* and *Rangiferinæ* (cont.)

- XVII. *PUDU* GRAY
 XVIII. *HIPPOCAMELUS* LEUCKART
 XVIIIA. *BLASTOCERUS* WAGNER
 XIX. *MAZAMA* RAFINESQUE, *OZOTOCEROS* AMEGHINO,
PALÆODOCOILEUS SPILLMANN;
PARACEROS AMEGHINO, *MORENELAPHUS* CARETTE AND
ANTIFER AMEGHINO

Figure 21

Statement.

One or more undescribed South American deer seem to be represented in the collections secured in Ecuador by John C. Blick and Charles Falkenbach in the winter of 1930–1931.¹

Numerous species have been described by several authors,² and the South American deer, Recent and fossil, are in great need of detailed revision. The most outstanding recent review, that of Kraglievich (1932), has suggested to the writer tentative recognition of some nine genera, Recent and extinct—the small and spike-horned *Pudu*; the forked-horned Andean *Hippocamelus*; *Blastocerus*, with anteriorly directed main beam; a group with branched horns, including *Odocoileus* (*Palæoodocoileus*), *Ozotoceros* and *Mazama*, and the three varied to indefinitely characterized extinct genera, *Paraceros*, *Morenelaphus* and *Antifer*. Certain of the remains of the three latter are indicative of possible *Rangifer* affinity. The hypothesis that Recent neotropical and Ethiopian forms represent so many remnants of earlier specializations now preserved far from the centers of original dispersal, presages the finding of near allies of the forms of the South American Quaternary in the Tertiary of North America.

¹ See *Cuvieronius humboldti* and *Cordillerion andium* remains: Nobis, 1933, Bull. Amer. Mus. Nat. Hist., LIX, p. 629, and Fig. 29A.

² Ameghino, F., 1889, Contribución al Conocimiento de los Mamíferos Fósiles de la República Argentina; Burmeister, H., 1879, Description physique de la République Argentine, III, Pt. 1; Carette, E., 1922, Revista del Museo de la Plata, XXVI; Castellanos, A., 1924, Revista de la Universidad Nacional de Córdoba, XI, Nos. 4–5–6; Kraglievich, L., 1932, Anales del Museo de Historia Natural de Montevideo (2), III; Rusconi, C., 1931, La Semana Médica, No. 53; Spillmann, F., 1931, Die Säugetiere Ecuadors im Wandel der Zeit, Pt. I.

The Ecuadorian *Cervus* species and *C. cf. chilensis*, listed by Branco,¹ and *C. chimborazi* and *C. riobambensis*, mentioned without description by Wolf,² seem to be indeterminate, though the latter has been identified with *Hippocamelus* by Kraglievich. Franz Spillmann (1931) discusses and partially figures Ecuadorian deer remains under several new genera and species—*Protomazama æquatorialis*, *Palæoodocoileus antonii*, *P. gracilis* and *P. abeli*.

Pudu and *Hippocamelus* are unrepresented in our Ecuadorian collections. The largest and most striking of the new remains are referred to *Blastocerus blicki*, n.sp. This form is exemplified by several antlers from Alangesi characterized by the disproportionate development of the anterior or "brow shaft" and abortion of the posteriorly directed "main shaft," and, in aged specimens, by the peculiar and heavily tuberculated condition of the horns. A somewhat similar appearing antler from Brazil is figured by Lydekker³ (Fig. 75) as representing a malformed individual of *Blastocerus* (*Mazama*) *dichotoma*. While the antlers of the new type specimen, an adolescent individual, are simply forked, a heavier referred partial antler is suggestive of the forward or "brow shaft" having been divided.

A very *Odocoileus*-like antlered deer is observed in a large series of remains including dentitions and limbs from the Punin area. The rami exhibit a relatively short diastema versus a specimen of the Recent *B. dichotoma* (A.M.[M.]36952), and shorter diastema and larger p_2 , but approximate-sized molars, compared to the Pleistocene *Odocoileus* species from El Casco, California. The remains are tentatively allocated to *Palæoodocoileus gracilis* Spillmann. A possible variant of the latter is represented by a large fragmental antler; and another and slightly smaller form is indicated by ramal portions from Punin. A fourth and even smaller-sized variant or species is witnessed by a few ramal fragments from the coastal oil fields about Salinas. This latter, which may be equivalent to the Spillmann *P. antonii*, does not much exceed in dimensions the Recent *Pudu*. Several of the Ecuadorian dentitions are characterized in unworn to moderately worn specimens by the detached antero-inner and posterior lophs of the p_4 (see Fig. 21), the latter condition being partially reminiscent of that in *Rangifer*. The anterior p_4 fossette is closed only in certain worn teeth. Examples of the antlers of *B. blicki* and of *P. gracilis*, ref., and of the ramal dentitions of the variants of the two latter, are figured on an adjoining plate (Fig. 21).

¹ Branco, W., 1883, Paleont. Abh., I, Hft. 2, p. 42.

² Wolf, T., 1892, Geografía y Geología del Ecuador, p. 373.

³ Lydekker, R., 1898, The Deer of All Lands.

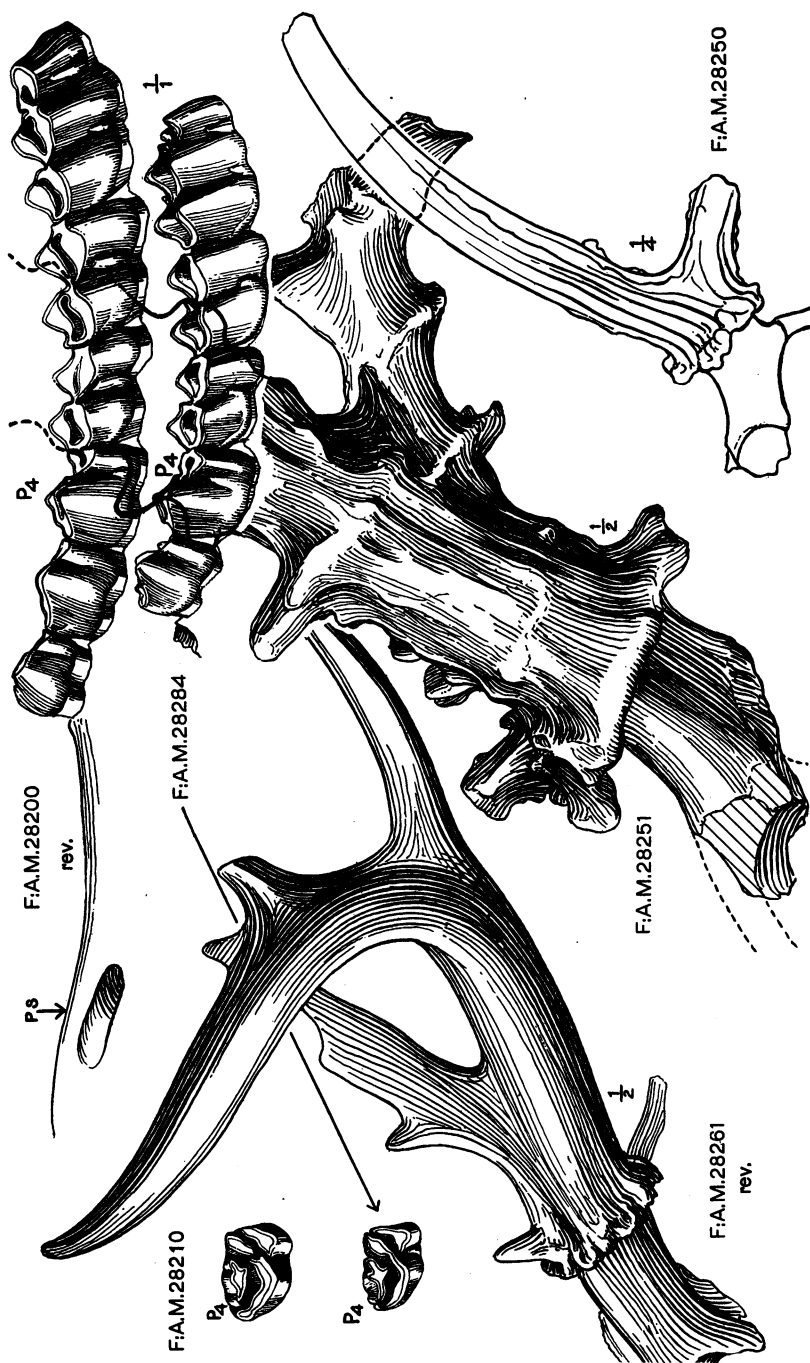


Fig. 21. *Palaeodocileus gracilis* Spillmann, ref., *P. salinae*, n.sp., type (F.A.M. 28284), and *Blastocerus bicki*, n.sp., ref. and type (F.A.M. 28251 and 28250), from the Pleistocene of Ecuador.
 Dentitions $\times 1$, antlers $\times \frac{1}{2}$ and $\frac{1}{4}$ (as indicated). (See legend, page 208.)

Summary of New Ecuador Species

(See measurement tables, pages 214, 210.)

The four species recognized in the new remains are:

SIZE GROUP I (LARGEST).

- (1)
- Blastocerus blicki*
- , n.sp., from Alangesi.

TYPE.—Frontals with antlers, F:A.M.28250. This paper, *Fig. 21*.SIZE GROUP II [AND II^x].

- (2)
- Palæoodocoileus gracilis*
- Spillmann, from Quebrada Chalang District.

TYPE.—Posterior portion of crushed skull.

REFERRED.—Frontals with antlers and associated maxilla, F:A.M. 28261. This paper, *Fig. 21*.

SIZE GROUP III.

- (3)
- Palæoodocoileus gracilis*
- , var., from Punin.

EXAMPLE.—Partial right ramus, F:A.M.28281.

SIZE GROUP IV.

- (4)
- Palæoodocoileus salinæ*
- , n.sp., from Salinas.

TYPE.—Partial left ramus, F:A.M.28284. This paper, *Fig. 21*.

FIG. 21. *Palæoodocoileus* Spillmann and *Blastocerus* Wagner, from the Pleistocene of Ecuador. (See pages 210, 213, 209.)

Dentitions $\times 1$, antlers $\times \frac{1}{2}$ and $\frac{1}{4}$ (as indicated). PS, posterior border symphysis.F:A.M.28200 (rev.) and 28210, *P. gracilis* Spillmann, ref., from Spring Quarry.F:A.M.28284, *P. salinæ*, n.sp., type, from Salinas.F:A.M.28261, *P. gracilis* Spillmann, ref., rev., from Spring Quarry.F:A.M.28251 and 28250, *B. blicki*, n.sp., ref. and type, from Alangesi.

Detailed Lists of Types and Referred Ecuador Specimens

Blastocerus, total available listed specimens, 6; *Palæodocoileus*, 149(1) *Blastocerus blicki*, new species

From Alangesi

TYPE.—Frontals with antlers. F:A.M.28250 From Mastodon Hill, Alangesi.
This paper, *Fig. 21*.

REFERRED.—

Four partial antlers on cranial fragments, from Alangesi:

Partial left frontal with F:A.M.28251 This paper, *Fig. 21*.
partial antler.

Left antler and two ant- F:A.M.28252-4
ler portions.

One example from San Francisco Wash:

Detached m². F:A.M.28257

(Unrepresented in limb elements.)

(2) *Palæodocoileus gracilis* Spillmann

From Quebrada Chalang District

Palæodocoileus gracilis SPILLMANN, 1931, Die Säugetiere Ecuadors im Wandel der Zeit, Pt. I, p. 31.

TYPE.—Posterior portion of crushed skull, left side nearly complete, right antler broken.

REFERRED FROM QUEBRADA CHALANG DISTRICT.—

PARTIAL ANTLERS, SKULLS OR FRONTAL FRAGMENTS

Seven specimens from Spring Quarry:

	F:A.M.		F:A.M.
Frontals with antlers.	28261	Posterior one-half male skull.	28267
(See maxilla.)	<i>Fig. 21</i>	Posterior one-half female skull. (See maxillæ.)	28230
Partial left frontal with antler (approximately twice the size of F:A.M.28261).	28262	Partial frontals.	28268
Left antler.	28263	Partial left frontal.	28269

SIXTEEN MAXILLÆ

Fourteen from Spring Quarry:

Right and left maxillæ with F:A.M.
p⁴-m³. (M) 28230
(See partial female skull.)

Right maxilla, p⁴-m³. (w) 28261
(See antlers. This paper, *Fig. 21*.)

Right maxilla, p²-m³. (w) 28231

Partial left maxilla with m¹-
m³. (M) 28273

Partial left maxilla with m¹-
m³. (M+) 28233

Partial left maxilla with p³
and m¹-m². (M+) 28234

Partial right maxilla with
m¹-m³. (M) 28235

Partial right maxilla with F:A.M.
m¹-m³. (M+) 28237

Partial left maxilla with m¹-
m². (w+) 28238

Partial left maxilla with p⁴-
m². (A) 28240

Partial right maxilla with
m²-m³. (M) 28241

Partial left maxilla with m²-
m³. (M+) 28239

Partial right maxilla with
m²-m³. (w) 28236

Partial left maxilla, p³. (w) 28242

One from Hillside Quarry:

Left maxilla, p²-m³. (w) 28272

One from Sloth Quarry:

Left maxilla, p²-m³. (M+) 28232

TWENTY-NINE RAMI

Two slightly larger ramal fragments from San Francisco Wash:

Partial right ramus with p₄-
m₃ (/ms br.). (w) 28256

Left fragment with p₃-p₄.
(M) 28255

Twenty-six more moderate-sized specimens:

Nineteen from Spring Quarry:

¹Right ramus with symphysis 28200
and p₂-m₃. (M+) *Fig. 21*

Left ramus with symphysis
and p₂-m₃. (M+) 28201

Left ramus with symphysis,
p₂ alveolus and p₃-m₃. (M+) 28202

Right ramus with symphy-
sis, p₂ alveolus, p₃-m₃. (w) 28203

Left fragment with p₃-m₃. 28210
(M) *Fig. 21* (p₄ only)

Left fragment with p₃-m₃. 28211
(M+)

Left fragment with p₂-p₃ and
m₂-m₃. (w+) 28212

Left fragment with p₂ al-
veolus and p₃-m₁. (M+) 28213

¹ Size of premolars relative to molars, as seen in three specimens:

	WEAR	SERIES	$\frac{p_2}{m_3}$
F:A.M.28200.....	(M+)	87 mm.	$\frac{35.7}{52.} = 69\%$
F:A.M.28201.....	(M+)	89	$\frac{36.5}{52.} = 70$
F:A.M.28207.....	(M+)	89	$\frac{36.5}{52.} = 70$

Left ramus with symphysis, F:A.M. p ₂ alveolus and p ₂ -m ₃ . (w) 28204	Right fragment with sym-F:A.M. physis, p ₂ alveolus, p ₃ -p ₄ . (m+) 28214
Partial left ramus with p ₂ al- veolus and p ₂ -m ₃ . (w) 28205	Right fragment with sym- physis, p ₂ alveolus and p ₃ . (m) 28215
Partial left ramus with p ₂ - m ₃ . (w) 28206	Right fragment with m ₁ -m ₃ . (A) 28216
Partial right ramus with p ₂ - m ₃ . (m+) 28207	Right fragment with m ₂ -m ₃ . (w+) 28217
Partial left ramus with p ₂ alveolus and p ₂ -m ₃ . (w+) 28208	Right fragment with m ₃ . (w+) 28218
Right fragment with sym- physis and p ₂ -m ₃ . (m+) 28209	Etc. detached teeth.

Seven from Hillside Quarry:

Left ramus with symphysis and p ₂ -m ₃ . (w) 28274	Partial right ramus with p ₂ - m ₃ . (w+) 28278
Left ramus with symphysis and p ₂ -m ₃ . (w+) 28275	Partial right ramus with p ₄ - m ₄ . (w) 28279
Left ramus with symphysis and p ₂ -m ₃ . (w) 28276	Right fragment with m ₃ . (w+) 28280
Partial left ramus with p ₄ - m ₃ . (w+) 28277	

One somewhat smaller-sized specimen than above, from Sloth Quarry:

Left ramus, p ₂ -m ₃ . (w+) 28228

RAMI, IMMATURE

Six from Spring Quarry:

Left ramus with symphysis and dp ₂ -m ₁ . 28222	Partial right ramus with al- veolus of dp ₂ and dp ₂ -m ₁ . 28225
Right ramus with symphysis and dp ₂ -m ₁ . 28223	Right fragment with dp ₂ -m ₁ . 28226
Partial left ramus, dp ₂ -m ₁ . 28224	Left fragment with m ₁ -m ₂ . 28227

LIMB ELEMENTS

The detached limb elements are listed under (a) larger, and (b) smaller-sized. The size difference presumably is due to individual and sexual variation. The largest metacarpus (F:A.M.28185) measures 188 mm., the smallest (F:A.M.28184B), 163 mm.; the largest metatarsus (F:A.M.28188) measures 226 mm., the smallest (F:A.M.28187E), 198 mm. (See measurements, Table V, page 214, and note composite skeleton.)

(a) Larger:

Distal four-fifths left humerus.	F:A.M.28199A	From Spring Quarry.
Two left and one right radii.	F:A.M.28198, B and A	" " "
Two left metacarpi.	F:A.M.28185,A	" " "
Left metacarpus.	F:A.M.28185B	From Hillside Quarry.
Distal two-thirds left femur.	F:A.M.28195B	From Spring Quarry.
Left tibia.	F:A.M.28192	From Hillside Quarry.
Two left tibiæ.	F:A.M.28191,A	From Spring Quarry.
Right metatarsus.	F:A.M.28188	" " "
Right metatarsus.	F:A.M.28188A	From Camel Hill.
Two right and one left metatarsi.	F:A.M.28188B, D and C	From Spring Quarry.
Several calcanea and astragali, carpal and tarsal bones, phalanges and vertebræ.		

(b) Smaller:

Left humerus, and fragment.	F:A.M.28199,C	From Spring Quarry.
Two right radii.	F:A.M.28197,A	" " "
Left radius.	F:A.M.28197B	From Sloth Quarry.
Left radius.	F:A.M.28197C	From Hillside Quarry.
Two left and one right metacarpi.	F:A.M.28184, A and B	From Spring Quarry.
Left metacarpus.	F:A.M.28184C	From Hillside Quarry.
Two right femora.	F:A.M.28194,A	From Sloth Quarry.
Right and two partial femora.	F:A.M.28196, A and B	From Spring Quarry.
Three right and three left tibiæ.	F:A.M.28189 and A-E	" " "
Four right and two left metatarsi.	F:A.M.28187 and A-E	" " "
Numerous calcanea, astragali, carpal and tarsal bones, phalanges and vertebræ.		

A composite skeleton has been built up from Spring Quarry remains, plus tibie from Sloth Quarry:

Left humerus, F:A.M.28199B; radii, F:A.M.28197E,D; metacarpi, F:A.M.28184E,D; 1st phalanges, F:A.M.28180, A-C; 2d phalanges, F:A.M.28180D-G; 3d phalanges, F:A.M.28180H-K; femora, F:A.M.28195, A; tibiae, F:A.M.28190, A; calcanea, F:A.M.28183, A; astragali, F:A.M.28182, A; metatarsi, F:A.M.28188E-F; 1st phalanges, F:A.M.28181, A-C; 2d phalanges, F:A.M.28181D-G; 3d phalanges, F:A.M.28181H-K.

[A larger form (Size Group II*) is exemplified by the peculiar base of an antler, F:A.M.28266.]

(3) *Palæoodocoileus gracilis*, Var.

From Punin

EXAMPLE.—Partial right ramus with p₄-m₄. (M+) F:A.M.28281

REFERRED.—

Partial left ramus with m₁-m₂. (M+) F:A.M.28282

(Limbs unrepresented.)

(4) *Palæoodocoileus salinæ*, new species

From Salinas

TYPE.—Partial left ramus with p ₂ -m ₃	(M)	F:A.M. 28284
	Fig. 21	

REFERRED FROM TYPE LOCALITY.—

Left antler.....		28264
Partial left frontal bone with partial antler.....		28265
Partial left maxilla with m ² -m ³	(M)	28283
Right fragment with p ₄ -m ₃	(W)	28285

Two limb elements of *P. gracilis* size:

Left radius.....	28197F
Right metatarsus (immature).....	28186

TABLE V
LIMB MEASUREMENTS AND RATIOS
Palaeodocileus gracilis SPILLMANN, REFERRED
[And Recent Deer for Comparison]

	Humerus	Radius	Metacarpus	Femur	Tibia	Metatarsus	Humerus/Radius	Metacarpus/Radius	Femur/Tibia	Metatarsus/Tibia	Metacarpus/Metatarsus	Radius/Tibia
<i>P. gracilis</i> Spillmann, ref., Ecuador (Composite skeleton).....	183	192	173	250	256	210	95	90	98	82	82	75
<i>P. gracilis</i> Spillmann, ref., Ecuador (Largest ¹ elements, unassociated).....	(204)	210	188	[265]	288	226						
(Smallest elements, unassociated).....	180	180	163	233	250	198						
<i>Odocoileus virginianus</i> , ♂ (Recent)....	197	218	208	252	280	244	81	95	90	87	83	78
" ♀ (Recent), N. Y. Zoo, aberrant.	165	188	190	218	245	220	98	100	92	90	86	76
<i>Odocoileus columbianus</i> , ♀ (Recent)....	191	200	182	245	276	224	95	91	92	90	81	76
<i>Cervus elaphus</i> (Recent).....	180	190	185	232	256	206	94	97	90	81	90	74

() approximate; [] estimated.

¹ As seen in the radii, the difference between the largest and smallest elements is 12%; in the humeri, the difference is 14%.

DIVISION D.—BLASTOMERYCINI

Frontispiece, c; Figures 22, 22A, 23, 23A, 24 and (in part) 3, 4, 4A;
Skeletal Elements 23B and (in part) 25, 25A, 25B

The diminutive hornless deerlets from the Late Tertiary, here held together under the Blastomerycini, include a number of ostensibly distinct forms that in certain instances differ widely in the proportions of the diastema and of the anterior premolars. The group seems best considered divided between two subfamilies, the Longirostromerycinae and Parablastomerycinae. The former is represented by the genera, *Longirostromeryx*, n.g., and *Blastomeryx* Cope, and the latter by *Parablastomeryx*, n.g., and *Pseudoparablastomeryx*, n.subg. Deerlets of the earlier Middle Tertiary, heretofore referred to *Blastomeryx* proper, are exemplified in the remains transferred to *Pseudoblastomeryx*, n.subg., in *Problastomeryx*, n.subg., and in the much smaller *Machæromeryx* Matthew. The three latter forms are treated separately under a Middle Tertiary (B) Section (page 251) and the Late Tertiary forms under (A) Section (page 217).

For distribution, see Cervidae distribution table, page 43.

The relatively primitive Parablastomerycinae may have lain close to the ancestral Cervid stem. The genesis of the comparatively highly specialized Longirostromerycinae possibly may be reproduced, in part, in the mandibular rami of the broadly contemporaneous forms—*Pseudoparablastomeryx scotti*, *Parablastomeryx gregorii*, *Blastomeryx gemmifer medius*, (?) *Longirostromeryx blicki* and *Longirostromeryx clarendonensis*, which in turn exhibit taller-crowned molars, smaller premolars and longer diastemata.

SUMMARY OF BLASTOMERYCINI SPECIMENS

Genus No.		Crania	Maxillæ	Mandibles	Limbs	Total Elements	Assoc. Elements	Total Specimens
(A) LATE TERTIARY								
XX	<i>Longirostromeryx</i> , n.g.	25	127	9	161			161
XXI	<i>Blastomeryx</i> Cope.	2	25[1]	60	26[1]	113	2	111
XXII	<i>Parablastomeryx</i> , n.g.	3	4[3]	10[1]	4[1]	21	5	16
XXIIA	<i>Pseudoparablastomeryx</i> , n.subg.		1	4	4	9		9
		5	55	201	48	304	7	297
(B) MIDDLE TERTIARY								
XXIII	<i>Machæromeryx</i> Matthew	1	[1]	[1]	[1]	4	3	1
XXIV	<i>Problastomeryx</i> , n.subg.	1	4[1]	7[2]	4[1]	16	4	12
XXV	<i>Pseudoblastomeryx</i> , n.subg.	4	6[4]	25[2]	27[3]	62	9	53
		6	11	33	32	82	16	66
Total Late Tertiary						304	7	297
Grand Totals						386	23	363

[] associated specimens.

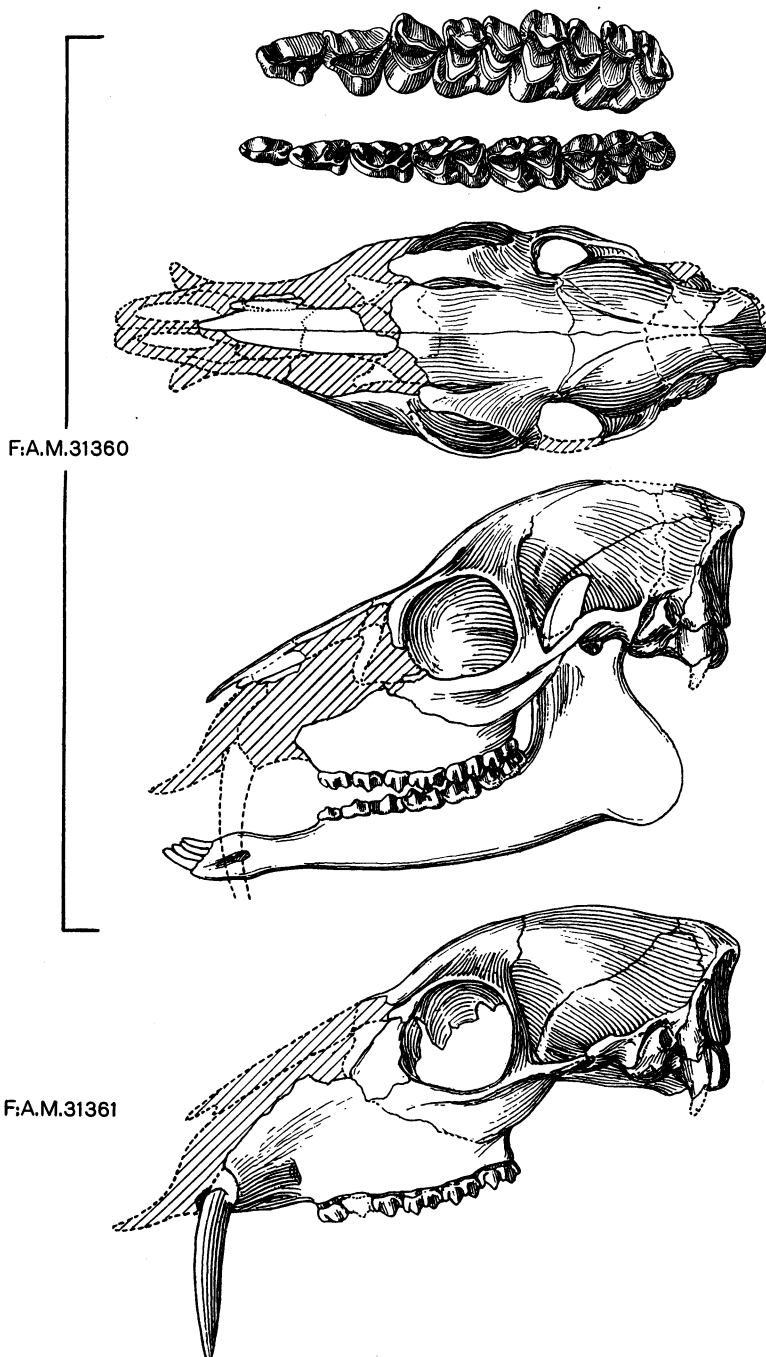


FIG. 22. F:A.M.31360 (genotype) and 31361 (ref.), *Parablastomeryx gregori*, n.g. and sp., from the Late Tertiary, Xmas Quarry, Cherry County, Nebraska.

Maxillary and mandibular dentitions, occlusal views $\times 1$; skulls and mandible, lateral and dorsal views $\times \frac{1}{2}$. (See also Figs. 25, 25B [F:A.M.31360, skeletal elements] and p. 243.)
See mandibular dentitions, Figs. 22A, 23 and 23A, pages 221-223.

(A) LATE TERTIARY SECTION

Subfamily 10.—*Longirostromerycinae*XX. *LONGIROSTROMERYX*, NEW GENUSXXI. *BLASTOMERYX* COPESubfamily 11.—*Parablastomerycinae*XXII. *PARABLASTOMERYX*, NEW GENUSXXIII. *PSEUDOPARABLASTOMERYX*, N. SUBG.

[(B) Middle Tertiary Blastomerycini, page 251.]

Frontispiece, c; Figures 22, 22A, 23, 23A and (in part) 3, 4, 4A

Statement

The new collections from the Late Tertiary contain a splendid series of *Blastomeryx*-like mandibles and other remains from New Mexico, and two largely complete skulls and an interesting series of mandibles from northern Nebraska. Hitherto, evidence as to the Late Tertiary Blastomerycini has been confined to the single m_3 s from Colorado and New Mexico of the Cope collection and a few mandibular fragments from other areas.

The *Blastomeryx* genotypic species is *B. gemmifer* Cope, from the Pawnee Creek, Colorado, the genotype being the m_3 of the Cope collection. The previously given skull characters of the genus proper have been based entirely on remains from the Lower Miocene. One of the new Nebraska skulls (*Parablastomeryx*) is associated with a mandible and complete series of limb elements. While the resemblance of this skull itself to the smaller *Moschus moschiferus* of Recent Asia is notable, the limbs are relatively much longer and heavier-proportioned than in the latter. The Blastomerycini, in mandibular characters, as a whole exhibit a far greater range of variation than do the Merycodontini. Thus in the relatively primitive *Parablastomeryx* the diastema is short and the premolars large; while in the highly specialized *Longirostromeryx* the diastema is extremely elongate and the premolars reduced. The evident elongation of the muzzle in the latter well may have been paralleled by equivalent specializations of the supra-orbital area and of the limbs.

The hypsodont tendency in the molars and the proportionate smallness of the premolars in *Longirostromeryx* actually are far more suggestive of *Aletomeryx* than of *Parablastomeryx*. In the new species, *L. clarendonensis*, the reduction of the premolars, with occasional loss of p_2 , is extreme and greater than in any other member of the Pecora vera here described. *Parablastomeryx* is so far definitely recognized only in the large Cherry County species. Moderate-sized *Blastomeryx* forms are known from Brown, Cherry, Dawes and Sioux Counties, Nebraska, and from Colorado and New Mexico. It is strange that no Blastomerycine remains so far have been observed in the very extensive collections from the Mojave Desert, California. *Longirostromeryx* species are recorded from South Dakota, from Brown, Cherry and Sioux Counties, Nebraska, and from New Mexico and Texas.

As seen in the fine new Nebraska specimens, the *Parablastomeryx* skull is hornless; the orbit anteriorly placed and closed; the bullæ moderate; the upper canines (male) large sabre-like; the lower canines small incisive-formed; the diastemata short (versus extremely long in *Longirostromeryx*); the p_1^1 lost; the cheek teeth very low-crowned (versus less so in *Longirostromeryx*); the premolars large (versus small in *Longirostromeryx*); the lower molars with Dromomerycine-like folds (often indistinguishable because of small size) and accessory columns; and the distal ends of lateral metacarpals and reduced lateral digits of manus and pes retained. The discussion of the osteology of *Blastomeryx* by Matthew (1908) was based wholly on remains from the Lower Miocene. Certain detached limb elements hypothetically are allocated to the several named Colorado, New Mexico and Sioux County, Nebraska, species and variants and a few shorter and heavier metapodials to the Sioux and Brown Counties, Nebraska, *B. elegans* and *B. mefferdi*. (See Figure 25A.)

Compared to Recent *Moschus* (A.M. [M.] 57078), the Nebraska *Parablastomeryx* skull (F:A.M. 31361) exhibits a basilar length of ((145)) versus 121 mm.; post C/ to foramen magnum distance, 120 versus 91 mm.; length of cheek tooth series, 54 versus 40 mm.; metacarpal length, 150 versus 93.5 mm.; percentage of cheek tooth series to basilar length, 38 versus 33%; percentage of cheek tooth series to foramen magnum-post C/ distance, 45 versus 44%; metacarpal length to basilar length, 97 versus 77%; foramen magnum-post C/ distance to length metacarpus, 125 versus 97%; and P.S. distance to cheek tooth series, 33 versus 53%. Compared to *Meryceros*, n.g. (N.S.M. 2-3-8-34), the Nebraska skull (F:A.M. 31361) is of approximately the same over-all length, but the

cranium, posterior to the orbits, is longer and narrower-proportioned, the frontals lack the interorbital elevation, horns are absent, the orbits are much larger, much more anteriorly placed and less produced laterally, the cheek tooth series occupies a proportionately larger area, and the upper canines are large and caniniform. In short, the form and proportions of both the cranium and the teeth, as well as of the limbs, are neither Moschine nor Merycodontine. A diminutive mandibular ramus with large, stubby-proportioned premolars and an abbreviation of the diastema exceeding that of *Parablastomeryx*, is tentatively placed under the latter as a subgenus, *Pseudoparablastomeryx*. A metatarsus from the same locality is the shortest so far known to the writer. The two specimens were secured long since these pages were consigned to the press.

It seems advisable to restrict the genus *Blastomeryx* to remains from the Late Tertiary and to transfer those Lower Miocene remains heretofore referred to the genus (see following section, page 251) to separate genera or subgenera, *Problastomeryx* and *Pseudoblastomeryx*.¹ With the questioned exception of *Machæromeryx*, so far as at present observable, the more typical of the Lower Miocene remains are prognostic of the short-diastemated and large-premolared and later *Parablastomeryx*.

The Blastomerycini specimens are subdivided for convenience according to the length of the molar tooth series. The dik-dik to roe-deer-sized remains on this basis fall into five size groups which approximate Size Groups III–VII of the Merycodontini.² It has seemed important in the case of the widely distributed *Blastomeryx* of Size Groups IV–V to continue to hold intact the several occurrences by treating the same as representing so many distinct species and subspecies. The two *Parablastomeryx* skulls and examples of the variable ramal dentitions of the several genera and subgenera are illustrated (Figs. 22, 22A, 23 and 23A). A reconstruction of the head in the flesh is given in the frontispiece (c). Limb elements associated with or hypothetically allocated among the Late Tertiary forms, and those elements associated with the latter described Lower Miocene specimens, are also exemplified [Figs. 23B and (in part) 25, 25A, 25B, and see Limb Sections, pages 245, 260].

¹ [*Sinclomeryx* (*Blastomeryx*-*Dyseomeryx*) *riparius* (Matthew, 1924), from Sheep Creek, Nebraska, (?) *Aletomeryx* (*Blastomeryx*) *scotti* (Matthew, 1924), from northern Nebraska, and (?) *Dromomeryx*, "*Blastomeryx* ?sp." Gazin (1932), from Skull Spring Miocene Quarry, Oregon, were formerly considered as of the genus *Blastomeryx*.]

² The largest size group (III+) of the Blastomerycini-Merycodontini is slightly smaller than the smallest size group (VI-) of the Dromomerycini-Aletomerycini.

Key to Genera and Subgenera

10. LONGIROSTROMERYCINÆ¹

Postsymphysial distance long.

Premolars reduced and tooth crowns subhypsodont:

Longirostromeryx merriami, n.g. and sp.

GENOTYPE.—Right ramus, F:A.M.32405, from Cherry County, Nebraska.

Size Group III. This paper, *Fig. 23A*.

(P.S. distance approximates 69% of cheek tooth series length.)

(?) *Longirostromeryx blicki*, n.sp.

TYPE.—Right ramus, F:A.M.31734, from Santa Clara, New Mexico.

Size Group v. This paper, *Fig. 22A*.

(P.S. distance as above, premolars less reduced.)

Premolars moderate and tooth crowns brachyodont:

Blastomeryx gemmifer Cope, genotypic species.

GENOTYPE.—Left m₃, A.M.8301, from Pawnee Creek, Colorado.

Size Group v. This paper, *Fig. 23*.

(In referred specimen F:A.M.31389, P.S. distance approximates 41% of cheek tooth series length.)

11. PARABLASTOMERYCINÆ

Postsymphysial distance short.

Premolars large and tooth crowns brachyodont:

Parablastomeryx gregorii, n.g. and sp.

GENOTYPE.—Skull, mandible and partial skeleton, F:A.M.31360, from east Cherry County, Nebraska. Size Group III+. This paper, *Figs. 22, 25*.

(P.S. distance is equivalent to 27% of cheek tooth series length, approximating proportions in *Pseudoblastomeryx advena*.)

Pseudoparablastomeryx scotti, n.subg. and sp.

SUBGENOTYPE.—Right ramus, F:B:A.M.33763, from Dawes County, Nebraska. Size Group VI. This paper, *Fig. 22A*.

(P.S. distance approximates 18% of cheek tooth series length.)

¹ See bottom of next page.

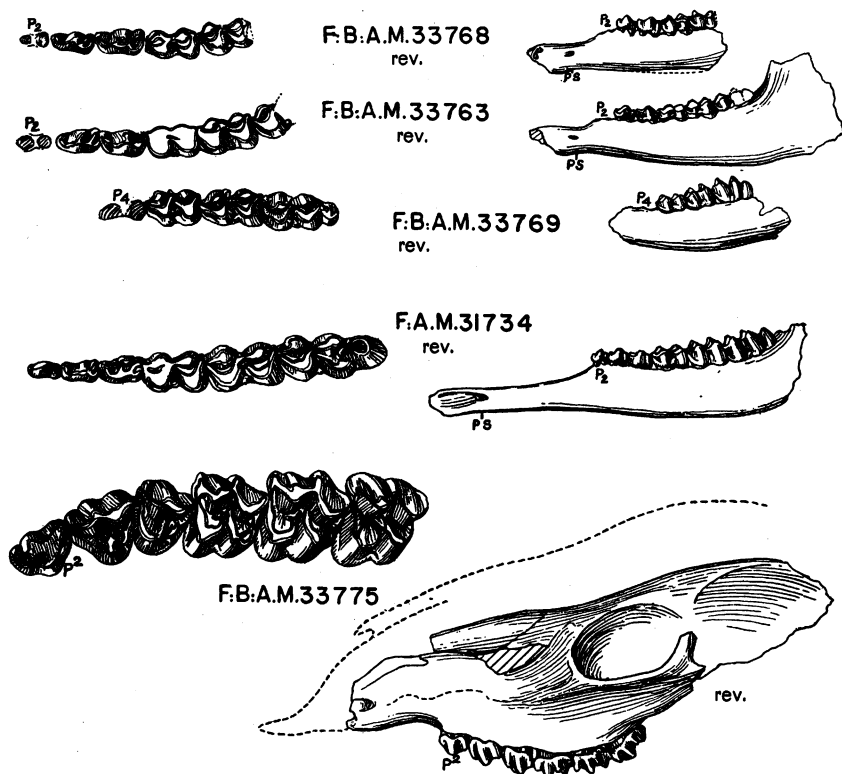


FIG. 22A. Blastomerycini from the Late Tertiary of Nebraska and New Mexico, skull and mandibular dentitions. (See pages 244, 235.)

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. PS, posterior border symphysis.

F:B:A.M.33768 (rev.), 33763 (subgenotype, rev.) and 33769 (rev.), *Pseudoparablastomeryx scotti*, n.subg. and sp., from Dawes County, Nebraska.

F:A.M.31734, (?) *Longirostromeryx blicki*, n.sp., type, rev., from North Santa Clara River, New Mexico.

F:B:A.M.33775, (?) *Parablastomeryx galushi*, n.sp., type, rev., from Dawes County, Nebraska.

A considerably larger species of (?) *Longirostromeryx* than any here described is suggested by a mandibular fragment (F:A.M.32915, with right p_4 - m_1 and alveoli of p_2 - p_3), from Pratt Ranch, Brown County, 1934. Reference doubtful—brachyodont, length of diastema unknown. Anteroposterior diameter p_4 = 7.8 mm.; m_1 = 9.8 mm. (A possibly allied form may be represented by indeterminate fragments from Midway Quarry.)

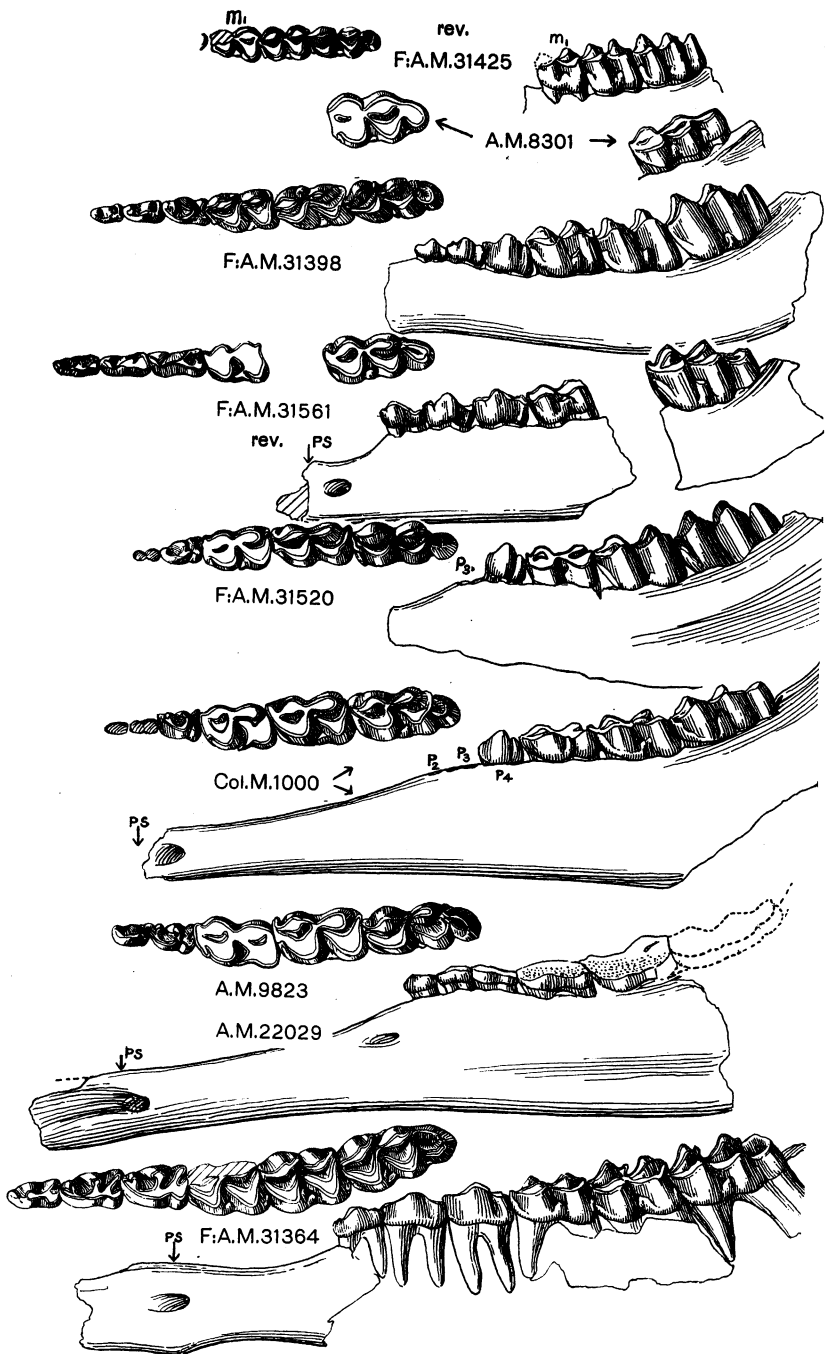


FIG. 23. *Blastomeryx* Cope, *Parablastomeryx*, n.g., ref., *Longirostromeryx*, n.g., and, for comparison, *Pseudoceras*, n.g. (F:A.M.31561), from the Late Tertiary of New Mexico, Colorado, Nebraska, Texas and South Dakota, mandibular dentitions, lateral and occlusal views compared.

× 1. (See legend, page 226.)

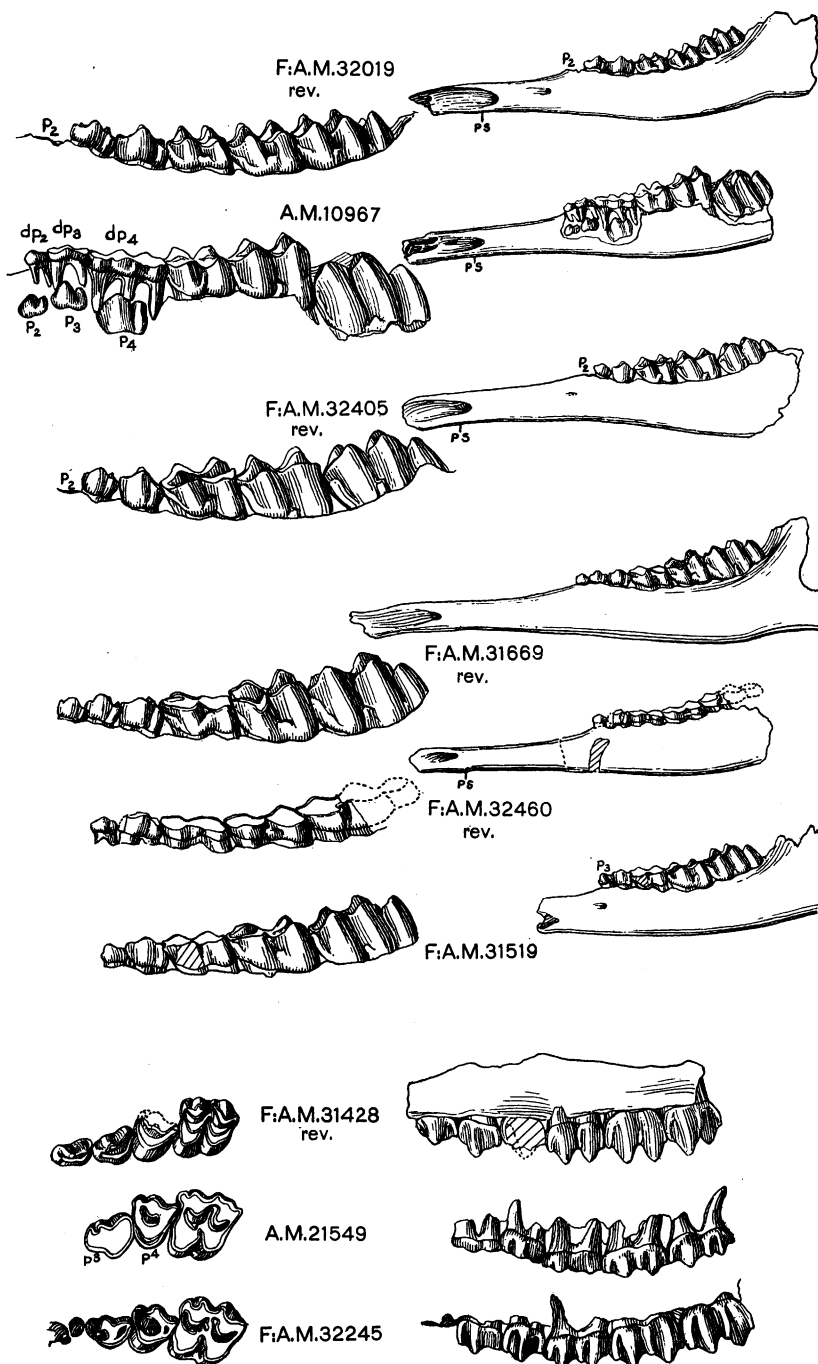


FIG. 23A. *Blastomeryx* Cope and *Longirostromeryx*, n.g., from the Late Tertiary of Nebraska, South Dakota, Texas and New Mexico, mandibular and maxillary dentitions compared.

Lateral views of rami $\times \frac{1}{2}$, of mandibular dentitions $\times 1$; lateral and occlusal views of maxillary dentitions $\times 1$. (See legend, page 226.)

Summary of Named Species and Subspecies from the Late Tertiary

The four genera and subgenera, and the some seventeen geographic and stratigraphic species¹ and subspecies of Size Groups III–VII, and their respective type specimens, may be summarized:

SIZE GROUPS III AND IV.

- (1) *Longirostromeryx wellsi* (Matthew), from Little White River, South Dakota. (s. g. III+.)

TYPE.—Left ramal fragment, A.M.9823. This paper, *Fig. 23*.

- (2) *Longirostromeryx merriami*, n.g. and sp. (s. g. III), and vars. A and B (s. g. IV), from Brown and Cherry Counties, Nebraska.

GENOTYPE.—Right ramus, F:A.M.32405. This paper, *Fig. 23A*.

- (2a) *Longirostromeryx serpentis*, n.sp., from Sioux County, Nebraska. (s. g. III.)

TYPE.—Left ramus, A.M.22029. This paper, *Fig. 23*.

- (3) *Longirostromeryx novomexicanus*, n.sp., from New Mexico. (s. g. III.)

TYPE.—Partial left ramus, F:A.M.31395. (/ps broken.)

- (4) *Longirostromeryx clarendonensis*, n.sp., from Texas. (s. g. III AND IV.)

TYPE.—Right ramus, F:A.M.31669. This paper, *Fig. 23A*.

- (4a) (?) *Longirostromeryx vigoratus* (Hay), from Texas. (s. g. IV.)

TYPE.—Left m₂–m₃, Mark Francis Coll.

SIZE GROUP V.

- (5)² (?) *Longirostromeryx blicki*, n.sp., from New Mexico.

TYPE.—Right ramus, F:A.M.31734. This paper, *Fig. 22A*.

SIZE GROUP IV.

- (6) *Blastomeryx elegans* Matthew and Cook, from Sioux County, Nebraska.

TYPE.—Partial left ramus, A.M.14101. (/ps large.)

¹ While the evidence is that the species are undoubtedly numerous, the data in many cases are unfortunately fragmentary.

²(5) also includes dentitions of Size Group IV–; (8c) includes referred material of Size Group VI.

SIZE GROUP V.

- (7) *Blastomeryx mefferdi*, n.sp., from Devil's Gulch, Brown County, Nebraska.

TYPE.—Partial left ramus, F.A.M.31375.

- (8) *Blastomeryx gemmifer* Cope, genotypic species, from Colorado.

GENOTYPE.—Left m₃, A.M.8301. This paper, *Fig. 23*.

- (8a) *Blastomeryx gemmifer medius* (Matthew), and var., from Sioux County, Nebraska.

TYPE.—Partial left ramus, A.M.18955. (/ps moderate.)

- (8b) *Blastomeryx gemmifer valentinensis*, n.subsp., from Valentine, and (8bb), (?)var. A, from Midway Quarry, Cherry County, Nebraska.

TYPE.—Partial left ramus, N.S.M.10-6-9-31. (/ps small.)

- (8c)¹ *Blastomeryx gemmifer*, var., from Montana.

EXAMPLE.—Partial right ramus, A.M.21356. [/ps large as in (7) *B. mefferdi*.]

- (9) *Blastomeryx mollis* Merriam, from Virgin Valley, Nevada.

TYPE.—m₃, U.C.11565 (or ?11564).

SIZE GROUP VI.

- (10) *Blastomeryx francesca*, n.sp., from New Mexico.

TYPE.—Left ramal fragment, F.A.M.31433.

SIZE GROUP VII.

- (11) *Blastomeryx francescila*, n.sp., from New Mexico.

TYPE.—Right m₁(br.)—m₃, F.A.M.31425. This paper, *Fig. 23*.

SIZE GROUP III+.

- (12) *Parablastomeryx gregorii*, n.g. and sp., from Xmas Quarry, east Cherry County, Nebraska.

GENOTYPE.—Skull, mandible and partial skeleton, F.A.M.31360. This paper, *Figs. 22, 25*.

REFERRED.—Left ramus, F.A.M.31364. This paper, *Fig. 23*.

¹See footnote 2, preceding page.

SIZE GROUP III.

- (13) (?) *Parablastomeryx galushi*, n.sp., from Dawes County, Nebraska.

TYPE.—Partial skull, F:B:A.M.33775. This paper, *Fig. 22A*.

SIZE GROUP VI.

- (14) *Parablastomeryx* (*Pseudoparablastomeryx*) *scotti*, n.subg. and sp., from Observation Quarry, Dawes County, Nebraska.

SUBGENOTYPE.—Mandibular ramus, F:B:A.M.33763. This paper, *Fig. 22A*.

The details regarding the above species, including synonymy and lists of referred remains, are given in the pages following the measurement tables and preceding the consideration of the Blastomerycine remains from the Lower Miocene.

FIG. 23. Blastomerycini mandibular dentitions from the Late Tertiary, lateral and occlusal views compared. (See pages 230–243, 651.)

× 1. PS, posterior border symphysis.

F:A.M.31425, *Blastomeryx francescita*, n.sp., type, rev., St. Cruz, N. Mex.

A.M.8301, *Blastomeryx gemmifer* Cope, genotype, Pawnee Creek, Colo.

F:A.M.31398, (?) *Longirostromeryx blicki*, n.sp., ref., St. Clara Canyon, N. Mex.

F:A.M.31561, *Pseudoceras wilsoni*, n.sp., type, rev., Brown Co., Nebr.

F:A.M.31520, *Longirostromeryx clarendonensis*, n.sp., ref., Carrell Creek, Tex.

Col.M.1000, *Longirostromeryx merriami*, var. A, Brown Co., Nebr.

A.M.9823, *Longirostromeryx wellsi* (Matthew), type, Little White Riv., S. Dak.

A.M.22029, *Longirostromeryx serpentis*, n.sp., type, Sioux Co., Nebr.

F:A.M.31364, *Parablastomeryx gregorii*, n.g. and sp., ref., Xmas Quarry, Cherry Co., Nebr.

FIG. 23A. Blastomerycini from the Late Tertiary, mandibular and maxillary dentitions compared. (See pages 230–240.)

Lateral views of rami × $\frac{1}{2}$, of mandibular dentitions × 1; lateral and occlusal views of maxillary dentitions × 1. PS, posterior border symphysis.

F:A.M.32019, *Blastomeryx elegans* Matthew and Cook, ?ref., rev., Sioux Co., Nebr.

A.M.10967, *Longirostromeryx wellsi* (Matthew), ref., S. Dak.

F:A.M.32405, *Longirostromeryx merriami*, n.g. and sp., genotype, rev., Cherry Co., Nebr.

F:A.M.31669 (type, rev.), 32460 (rev.) and 31519, *Longirostromeryx clarendonensis*, n.sp., Clarendon, Tex.

F:A.M.31428, (?) *Longirostromeryx blicki*, n.sp., ref., rev., St. Cruz, N. Mex.

A.M.21549, *Blastomeryx gemmifer medius* (Matthew), var., ref., Sioux Co., Nebr.

F:A.M.32245, *Longirostromeryx merriami*, var. B, ref., Cherry Co., Nebr.

TABLE VI
BLASTOMERYCINI MANDIBLES
COMPARATIVE MEASUREMENTS AND RATIOS

	Size Group	Collection No.	Tooth Wear	$\frac{m_3}{PS\ d.}$	$\frac{P_2-P_4}{m_1-m_3}$	$\frac{P_2}{P_4}$	$\frac{P_2}{m_3}$	$\frac{P_2}{P_4}$	$\frac{P_2}{m_3}$	$\frac{P_2}{P_4}$	$\frac{P_2}{m_3}$	See Fig.
[Millimeters]												
LATE TERTIARY:												
<i>Parablastomeryx gregorii</i> , ref., E. Cherry Co., Nebr.....	III+	F.A.M.31364	M	$\frac{14.7}{21.} = 70\%$	$\frac{23.7}{35.5} = 67\%$	$\frac{7.4}{8.9} = 83\%$	50%	$\frac{8.3}{8.9} = 93\%$	$\frac{56\%}{56\%}$	$\frac{23}{23}$		
"	"	F.A.M.31363	W+++	$\frac{15.5}{21.} = 74$	$\frac{((22.))}{35.} = ((63))$	$\frac{8.5}{8.5}$		$\frac{8.2}{8.5} = 96$	53			
" genotype ¹	"	F.A.M.31360	-M	$\frac{14.}{18.} = 78$	$\frac{23.}{33.} = 70$	$\frac{6.5}{8.5} = 76$	46	$\frac{8.3}{8.5} = 98$	59	22		
<i>Longirostomeryx wellsi</i> (Matthew), type, L.W.R., S. Dak.....	"	A.M.9823	M+	14.5	$\frac{((14.4))}{36.} = ((40))$	$\frac{6.5}{6.5}$		$\frac{5.2}{6.5} = 80$	36	23		
<i>L. serpentina</i> , n.sp., type, Sioux Co., Nebr.....	III	A.M.22029	W++	38.	$\frac{(14.5)}{(14.5)}$	$\frac{4.2}{6.3} = 67$		$\frac{4.7}{6.3} = 75$	75	23		
<i>L. merriami</i> , genotype, Cherry Co., Nebr.....	"	F.A.M.32405	M	$\frac{14.7}{33.} = 45$	$\frac{((14.))}{36.} = ((39))$	$\frac{6.2}{6.2}$		$\frac{4.8}{6.2} = 77$	33	23A		
" var. A, example, Brown Co., Nebr.....	IV	Col.M.1000	M+	$\frac{13.7}{35.} = 39$	$\frac{((13.))}{32.5} = ((40))$	$\frac{6.}{6.}$		$\frac{6.}{6.}$		23		
<i>L. novomexicanus</i> , n.sp., type, N. Mex.	III	F.A.M.31395	M	14.	$\frac{13.5}{34.} = 40$	$\frac{6.}{6.}$		$\frac{6.}{6.}$				
<i>L. clarendonensis</i> , n.sp., type, Tex...	"	F.A.M.31669	M+	$\frac{15.5}{34.} = 46$	$\frac{14.}{34.} = 41$	$\frac{4.}{6.} = 67$	26	$\frac{5.}{6.} = 83$	32	23A		
" ref. (<i>P.</i> absent).....	IV	F.A.M.32460	W+	34.	$\frac{(9.5)^2}{(9.5)^2}$	$\frac{(5.6)}{(5.6)}$		$\frac{3.7}{(5.6)} = (86)$		23A		

(Continued on next page)

TABLE VI—Continued

Size Group	Collection No.	Tooth Wear	$\frac{m_2}{PS d.}$	$\frac{p_1-p_4}{m_1-m_2}$	$\frac{p_2}{p_4}$	$\frac{p_1}{m_1}$	$\frac{p_3}{p_4}$	$\frac{p_3}{m_3}$	See Fig.
<i>L. clarendonensis</i> , ref. (p_2 absent)...	F.A.M. 31519	M++	$\frac{13.3}{-}$	$\frac{9.2}{32.5} = 28$	$\frac{5.5}{-}$		$\frac{3.6}{5.5} = 65$	27	23A
" " " " " " " " " " " "	F.A.M. 31520	M	$\frac{13.}{-}$	$\frac{31.5}{((9.))} = ((29))$	$\frac{((6.))}{-}$		$\frac{((6.))}{-}$		23
(?) <i>L. blicki</i> , n.sp., ref., N. Mex.	F.A.M. 31398	-M	$\frac{12.3}{-}$	$\frac{15.}{30.4} = 49$	$\frac{4.3}{6.2} = 69$	35	$\frac{5.4}{6.2} = 87$	44	23
" " ref. (smaller)	F.A.M. 31420	W	$\frac{11.}{-}$	$\frac{14.2}{27.} = 53$	$\frac{3.6}{5.8} = 62$	33	$\frac{5.}{5.8} = 86$	45	
<i>Blastomeryx elegans</i> M. and C., ref., Sioux Co., Nebr.	A.M. 17345	M	$\frac{14.}{-}$	$\frac{19.}{32.} = 59$	$\frac{5.3}{7.5} = 71$	38	$\frac{6.5}{7.5} = 87$	46	
" " type.	A.M. 14101	M	$\frac{12.5}{-}$	$\frac{30.5}{((17.4))} = ((57))$	$\frac{7.4}{-}$		$\frac{6.5}{7.4} = 88$	52	
" " ?ref.	F.A.M. 32019	M	$\frac{12.}{23.} = 52$	$\frac{((18.))}{28.} = ((64))$	$\frac{7.2}{-}$		$\frac{6.3}{7.2} = 87$	53	23A
<i>B. gemmifer valentinensis</i> , type, Cherry Co., Nebr.	N.S.M. 10-6-9-31	M+	$\frac{12.6}{-}$	$\frac{16.}{29.5} = 54$	$\frac{4.3}{7.} = 61$	34	$\frac{5.5}{7.} = 79$	44	
<i>B. mefferdi</i> , n.sp., type, Brown Co., Nebr.	F.A.M. 31375	M	$\frac{12.5}{-}$	$\frac{((17.))}{28.5} = ((60))$	$\frac{6.8}{-}$		$\frac{6.}{6.8} = 88$	48	
<i>B. gemmifer</i> , var., example, Mont.	A.M. 21356	M+	$\frac{12.}{((19.))} = ((63))$	$\frac{17.3}{27.5} = 63$	$\frac{5.1}{7.} = 73$	43	$\frac{6.5}{7.} = 93$	54	
<i>B. g. medius</i> (Matthew), type, Sioux Co., Nebr.	A.M. 18955	M+	$\frac{12.}{-}$	$\frac{16.4}{28.} = 59$	$\frac{4.8}{6.6} = 73$	40	$\frac{6.}{6.6} = 90$	50	
" " ref.	F.A.M. 31389	W	$\frac{11.}{18.} = 61$	$\frac{((16.2))}{25.8} = ((63))$	$\frac{7.}{-}$		$\frac{6.}{7.} = 90$	50	

<i>B. gemmifer</i> Cope, ref., N.E. Colo....	V	A.M.9449	W++	11. —	16.7 25.5	= 65	((5.)) ((6. +))	(45)	5.7 (6. +))	= ((95))	51
<i>B. francescita</i> , n.sp., type, N. Mex...	VII	F.A.M.31425	M	9. —	(21.5)						23
MIDDLE TERTIARY:											
<i>Problastomeryx olcottii</i> (Matthew), type, Lusk, Wyo.....	III	A.M.13224	M+	12. —	((20.)) 28.	= ((71))	7.8		7.8 7.8	= 100	65
<i>P. primus</i> (Matthew), subgenotype, U. Rosebud, S. Dak.....	"	A.M.13822	W+	12.5 = (60) (21.)	19.3 28.	= 69	6. 7.5	80	7.2 7.5	= 96	58.24
<i>Pseudoblastomeryx falkenbachii</i> , ¹ n.sp., ?ref., Lusk, Wyo.....	IV	F.A.M.31532	W	12. — = 86 14.	20. 27.5	= 73	6. 7.5	80	7.5 7.5	= 100	63
" ref.....	V	F.A.M.31531	M	10.8 = 82 13.2	18. 26.	= 69	5.4 6.9	78	6.4 6.9	= 93	59.24
<i>P. schultzei</i> , n.sp., type, Morrill Co., Nebr.....	"	N.S.M.128-25-6-35	M+	11.4 = 71 16.	17.5 27.	= 65	4.7 6.7	70	6.2 6.7	= 93	54.24
" ref.....	"	N.S.M.127-25-6-35	M+	11. — = 69 16.	((17.7)) 25.7	= ((69))	6.7		6.5 6.7	= 97	59
<i>P. advena</i> (Matthew), type, Rosebud, S. Dak.....	V	A.M.13014	M	11. — = (83) (13.3)	((19.)) 25.5	= ((75))	6.8		6.5 6.8	= 95	59.24
<i>Machzoromeryx tragulus</i> ¹ Matthew, genotype, ?U. Harrison, Nebr.....	VII+	A.M.20548	M+	9.5 = 51 18.5	12.5 21.	= 60	3.2 5.3	60	4. 5.3	= 75	42.24

() approximate; (()) estimated.

¹ Length metacarpus/vertex length skull: *Parablastomeryx gregorii*, F.A.M.31360, (94)%; *Pseudoblastomeryx falkenbachii*, F.A.M.31530, (75)%; *Machzoromeryx tragulus*, A.M.20348, (66)%. See introduction, page 24.

² Measurement cited is pr-pi (Gr absent).

Detailed Lists of Types, Referred Specimens, and Synonymy

Longirostromeryx, total available listed specimens, 161; *Blastomeryx*, 111; *Parablastomeryx*, 16; *Pseudoparablastomeryx*, 9.

(Mandibular Measurement Table VI, pages 227-229)

(Skeletal elements, associated or referred, are listed separately, p. 246.)

XX. LONGIROSTROMERYX, NEW GENUS

(Size Groups III and IV alone represented.)

(Mandibular ramus and symphysis extremely long and slender; diastema elongate and unusually developed; p_1 - p_2 greatly reduced and anteroposterior length equivalent to 40% of length from postsymphysis to p_2 . In *L. clarendonensis*, the most specialized species so far observed, p_2 is usually absent.)

SIZE GROUPS III AND IV.

(1) *Longirostromeryx wellsi* (Matthew)

From Little White River, South Dakota

(Size Group III+)

Blastomeryx wellsi MATTHEW, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 125, Fig. 18; 1908, *ibid.*, XXIV, p. 545.

Blastomeryx cf. *wellsi* MATTHEW, 1924, *ibid.*, L, p. 196.

TYPE.—Left fragment with p_1 - m_3 . (M+)

A.M.9823

Collected in 1902 by H. F. Wells.

Figured by Matthew, 1904, Fig. 18; this paper, Fig. 23.

REFERRED.—

Left ramus with symphysis, dp_1 - m_3 (erupting), p_1 - p_4 germs.

A.M.10967

Collected in 1903.

This paper, Fig. 23A.

(2) *Longirostromeryx merriami*, new genus and species

From Cherry and Brown Counties, Nebraska

(Size Group III)

GENOTYPE.—Right ramus with diastema beautifully preserved, p_2 alveolus and p_1 - m_3 . (M)

F:A.M.32405

From Bear Creek, Cherry County, 1934.

This paper, Fig. 23A.

REFERRED.—

Left fragment with m_2 - m_3 .	F:A.M.32406	From type locality, 1934.
Doubtful (/ps larger):		
Left fragment with p_1 - p_4 alveoli and m_1 - m_3 . (M)	F:A.M.31356	From Horsethief Canyon, Brown County, 1929.
Immature partial right fragment with p_3 , germ of p_4 and dp_4 - m_2 .	F:A.M.31369	"

Var. A

(Dentitions tending less tall, near Size Group IV)

EXAMPLE.—Left ramus with diastema, p_2 - p_3 alveoli and p_4 - m_3 . (M+)	Col.M.1000	From Quinn Ranch, collected by N. J. Vaughan, 1930. This paper, <i>Fig. 23</i> .
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REFERRED FROM QUINN RANCH, BROWN COUNTY.—

Partial right ramus with p_2 - p_4 alveoli and m_1 - m_3 . (M+)	F:A.M.31355	1928.
Left fragment, m_2 - m_3 . (W)	F:A.M.31357	1928.
Right fragment with m_2 - m_3 . (W)	Col.M.1001	Collected by N. J. Vaughan, 1930.
Left fragment with m_3 .	F:A.M.31358	1927.
See metatarsus, page 247.		

Var. B

Smaller (/ps larger)

From Burge Quarry, Cherry County, 1934-35

REFERRED.—

Right ramus with partial diastema, p_2 - p_3 alveoli and p_4 - m_2 (M+); left m_3 .	F:A.M.32246 and A
Left fragment with p_2 - m_3 . (M++)	F:A.M.32905
Right fragment with m_1 - m_3 and detached symphysis. (W)	F:A.M.32246B

- Left ramus, p_4-m_3 . (w+) N.S.M.22-14-6-34
 Left maxilla with p^2 alveolus and p^3-m^2 . (M+) F.A.M.32245 This paper, Fig. 23A.
 Left maxilla, p^4-m^3 . (M++) F.A.M.32245A
 See metacarpus, page 247.

Two fragments from Boiling Springs:

- Left p_3-m_1 . (M) F.A.M.32408
 Left m_1-m_3 . (M) F.A.M.32409

QUESTIONABLY REFERRED FROM WILLOW CREEK, 5 MILES N.W. OF LONG PINE, BROWN COUNTY.—

- Right fragment with symphysis, p_2 alveolus and p_3-p_4 . (M) F.A.M.31556 1930.
 (Adolescent, and diastema relatively short.)

(2a) *Longirostromeryx serpentis*, new species

From Sioux County, Nebraska

(Size Group III)

Blastomeryx cf. *wellsi* MATTHEW, MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 411.

- TYPE.—Left ramus with symphysis and p_2-m_2 . (w++) A.M.22029 From Kilpatrick Pasture, Quarry 7, 1926.
 This paper, Fig. 23.

REFERRED FRAGMENTS FROM OLCOTT HILL, 1925.—

- Left fragment, p_2-m_1 . (M) A.M.18847
 Right fragment with alveolus and p_3-p_4 . (w++) A.M.18846
 Left fragment with p_2-p_4 alveoli and m_1 (br.)- m_2 . (M+) A.M.21471
 Large canine. A.M.21471A
 Three /ms. A.M.14118 From Snake Creek area, 1908.
 (Mentioned by W. D. Matthew.)

See metatarsus, page 247.

(3) *Longirostromeryx novomexicanus*, new species

From New Mexico

(Size Group III)

TYPE.—Partial left ramus with F:A.M.31395 From upper layer, Santa
 p_2 - p_3 alveoli and p_4 - m_3 . (M) Cruz, 1927.

May be further represented in the collection by fragmentary specimens. (See measurement table, page 227, and referred metatarsus, page 247.)

(4) *Longirostromeryx clarendonensis*, new species

From Clarendon, Texas

(Size Groups III and IV)

P_2 tending totally lost, p_2 - p_4 greatly reduced, molars moderately subhypsodont. Two forms may be represented: A smaller-sized species, represented by three specimens in all of which the p_2 is lost, and a larger-sized form in which this tooth is retained. The larger form in size approximates that from Bear Creek, but apparently exceeds this in the great length of the diastema.

TYPE.—Right ramus with F:A.M.31669 From MacAdams Quarry,
 symphysis and p_2 - m_3 . 1935.
 (M+) This paper, Fig. 23A.

REFERRED FROM TYPE LOCALITY.—

Right ramus with poste- F:A.M.33022 1936.
 rior symphysis, p_2 - m_3 . (w)
 (Not included in specimen count.)

Crushed right ramus with F:A.M.32462 1935.
 diastema, p_2 roots and p_2 -
 m_3 . (w++)
 (Premolars of larger size.)

Smaller (Size Group IV):

Right ramus with sym- F:A.M.32460 1935.
 physis, p_2 and p_4 (br.)- m_3 This paper, Fig. 23A.
 (br.). (w+)

Left ramus with portion of diastema, p_1 - m_3 . (M++)	F:A.M.31519	1935. This paper, <i>Fig. 23A</i> .
Right m^3 [and dp_4].	F:A.M.31521 [and A]	
Left fragment with p_3 al- veolus and p_4 - m_3 (p_2 al- veolus absent). (M)	F:A.M.31520	(From Carrell Creek, 1929.) This paper, <i>Fig. 23</i> .

See metatarsus, page 247.

(4a) (?) *Longirostromeryx vigoratus* (Hay)

From Texas

(Size Group ?iv)

[Length of symphysis indeterminate and proportions of p_4 unknown. May represent the same form as (4). The three specimens listed below are in the Mark Francis collection, College Station, Texas.]

Blastomeryx vigoratus HAY, 1924, Proc. Biol. Soc. Wash., XXXVII, p. 16, Pl. II, Figs. 13-18.

TYPE.—Left m_2 and m_3 .
Moderately worn.

From Garvin Gully.
Figured by Hay, 1924, Pl. II,
Figs. 13, 14.

REFERRED.—

m^3 , right.
Unworn.

Figured by Hay, 1924, Pl. II,
Figs. 17, 18.

m_1 , right, in fragment of jaw.
 $m_1 = 10$ mm.

Figured by Hay, 1924, Pl. II,
Figs. 15, 16.

(5) (?) *Longirostromeryx blicki*, new species

From New Mexico

(The species includes dentitions of Size Groups iv- to v. Premolars less reduced than in *Longirostromeryx* proper. Tooth crowns as tall as *B. elegans* versus *B. gemmifer medius*.)

Dicrocerus gemmifer COPE, referred, and *Blastomeryx gemmifer* COPE, 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, pp. 360, 350, Pl. LXXXII, Figs. 13, 13a. 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, p. 32.

TYPE.—Right mandibular ramus with symphysis and p_2 - m_3 . (w)	F:A.M.31734	From N. Santa Clara River, 1936. This paper, <i>Fig. 22A</i> .
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REFERRED FROM SANTA CLARA.—

Left fragment, p_2 - m_3 . (A)	F:A.M.31398	Santa Clara Canyon, 1930. This paper, <i>Fig. 23</i> .
Right fragment with p_4 - m_3 (br.). (M)	F:A.M.31415	From Santa Clara, 1928.
Right fragment, p_2 - m_3 . (-M)	F:A.M.31416	Santa Clara Canyon, 1930.
Right ramus, dp_4 (br.)- m_3 .	F:A.M.31417	Santa Clara Canyon, 1930.

REFERRED FROM SANTA CRUZ.—

Partial right ramus with p_2 alveolus, p_2 - m_3 (br.). (M)	F:A.M.31399	From red layer, 1925.
Right fragment, p_2 - m_3 . (M+)	F:A.M.31400	
Right fragment, p_2 - m_3 . (M)	F:A.M.31401	From red layer, 1927.
Left fragment with p_2 - m_3 (p_4 and m_3 br.). (w)	F:A.M.31426	From red layer, 1927.
Right fragment with p_2 alveolus and p_2 - m_3 . (M)	F:A.M.31402	From 2d wash, 1927.
Left fragment, p_4 - m_3 . (w)	F:A.M.31427	From 2d wash, 1930.
Right fragment, p_2 - m_3 . (M)	F:A.M.31404	1926.
Left fragment with p_2 and p_4 - m_3 . (w)	F:A.M.31405	From red layer, 1927.
Left fragment with p_2 alveolus and p_2 - m_3 . (w++)	F:A.M.31406	From red layer, 1927.
Right fragment, p_4 - m_3 . (M)	F:A.M.31407	From red layer, 1927.
Right fragment with p_2 - m_3 (br.). (A)	F:A.M.31408	From 1st wash, lower layer, 1928.
Left fragment, m_1 - m_3 . (M+)	F:A.M.31409	From red layer, 1927.
Right fragment, m_1 - m_3 . (M+)	F:A.M.31410	1926.
Left fragment, m_1 - m_3 . (w+)	F:A.M.31411	1927.
Left fragment, m_1 - m_3 . (w++)	F:A.M.31412	From red layer, 1927.
Right fragment, m_1 - m_3 . (w+)	F:A.M.31413	From red layer, 1927.

Right fragment with m_1-m_3 (br.). (M+)	F:A.M.31414	From red layer, 1927.
Right fragment with p_2-m_3 .	F:A.M.31419	1927.
Left fragment, p_2-m_3 . (M+)	F:A.M.31403	1925.
Left ramus with dp_4 (br.)- m_2 .	F:A.M.31418	

REFERRED FROM GENERAL AREA.—

Right fragment with m_3 .	N.M.2360 Cope Coll.	From the Santa Fé marls, 1874. Figured by Cope, 1877, Pl. LXXXII, Figs. 13, 13a.
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Cope (1877, pp. 350, 360) remarks that his specimen from the Santa Fé marls resembles closely the more fully worn Colorado type m_3 . According to Cope, "long diameter of crown" measured 12 mm.

Our collection includes some seventy-five unlisted fragmental rami and immature mandibular and maxillary specimens.

REFERRED MAXILLARY SPECIMENS FROM SANTA CRUZ.—

Partial palate, p^4-m^3 . (M)	F:A.M.31429	1927.
Partial right maxilla with p^4-m^3 . (M)	F:A.M.31430	1926.
Partial right maxilla with m^1-m^3 . (M)	F:A.M.31432	

SMALLER SPECIMENS FROM SANTA CRUZ.—

Right fragment, p_2-m_3 . (M+)	F:A.M.31421	From 1st wash, 1928.
Right fragment, p_2-m_3 . (M)	F:A.M.31422	From 1st wash, 1928.
Left fragment, m_1-m_3 . (W)	F:A.M.31423	From 2d wash, 1927.
Right fragment, m_1-m_3 . (M)	F:A.M.31424	From red layer, 1927.
Right fragment, p_2-m_3 . (W)	F:A.M.31420	From Santa Fé area, 1925.
Etc. ramal fragments.		
Right maxilla with p^2-m^3 . (M)	F:A.M.31428	From 1st wash, 1928. This paper, <i>Fig. 23A</i> .
Partial right maxilla with m^1-m^3 . (M)	F:A.M.31431	1927.

See Limb Section, page 247.

XXI. BLASTOMERYX COPE

(Size Groups IV-VII)

SIZE GROUP IV.

(6) *Blastomeryx elegans* Matthew and Cook

From Sioux County, Nebraska

Blastomeryx elegans MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 410, Fig. 23. MATTHEW, 1918, *ibid.*, XXXVIII, p. 218; 1924, *ibid.*, L, p. 196.

TYPE.—Partial left ramus with A.M.14101 From Snake Creek, *M. pan-*
 p_2 - m_3 . (M) *ensis* zone, 1908.
 Figured by Matthew and
 Cook, 1909, Fig. 23.

REFERRED FROM SNAKE CREEK BEDS.—

Five mature partial rami:

	A.M.
Partial left ramus with p_2 - m_3	(M) 17345
Right fragment with p_2 alveolus and p_2 - m_3	(M+) 17341
Right fragment with m_1 (br.)- m_3	(M+) 17347
Left fragment with m_1 - m_3	(W) 17348
Right fragment with m_2 - m_3	(W+) 17309

Two immature rami:

Left fragment with dp_1 - dp_2 alveoli, dp_2 - m_3 (br.).....	17346
Right fragment with dp_2 - m_3	17349

QUESTIONABLY REFERRED FROM ANTELOPE DRAW.—

(Diastema longer, /ps relatively larger and /ms slenderer, versus above. Perhaps distinct species.)

Right ramus with sym- F.A.M.32019 From campsite, Echo Quarry, physis, p_2 alveolus and p_2 - 1935. m_3 . (M) This paper, Fig. 23A.	
Left fragment, p_2 - m_3 . (W+) F.A.M.31385 1933.	
Large C/. F.A.M.32019A	

See Limb Section, page 247.

TENTATIVELY REFERRED VAR. FROM OBSERVATION QUARRY, DAWES COUNTY, COLLECTED BY T. GALUSHA, 1936.—

(Molars heavy, brachyodont, p_2 greatly reduced.)		F:B:A.M.
EXAMPLE.—Left fragment with p_2 - m_3	(M)	33776
Partial skull with left m^1 - m^2 (right maxilla and muzzle missing).....	(W)	34051
Posterior portion of skull with frontlets.....		34051A
Left ramus with symphysis and p_2 - m_3 (br.).....	(W++)	34054
Right ramus with diastema and p_2 - m_3	(W+)	33760
Left fragment with m_1 - m_3	(M)	33761
Left immature ramus with dp_2 - m_3		34053
Left maxilla with p^2 - m^3	(M)	34052
Partial right maxilla with p^4 , m^1 (br.), m^2 and m^3	(M+)	33762

SIZE GROUP V.

(7) *Blastomeryx mefferdi*, new species

From Devil's Gulch, Brown County, Nebraska

TYPE.—Partial left ramus with p_2 alveolus and p_2 - m_3 . (M)	F:A.M.31375	From Horse Quarry, Devil's Gulch, 1933.
(Taller-crowned than <i>B. gemmifer</i> group.)		

REFERRED.—

Right fragment with p_2 - p_3 alveoli and p_2 - m_3 . (M)	F:A.M.31381	From Devil's Gulch, 1934.
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REFERRED, TWO IMMATURE RAMI.—

Partial left ramus with dp_2 - dp_3 alveoli, dp_2 - m_3 and m_3 germ.	F:A.M.31378	From general area.
Right fragment with dp_2 - dp_3 alveoli and dp_2 - m_3 (br.).	F:A.M.31380	From Horse Quarry, Devil's Gulch, 1933.

See Limb Section, page 248.

(8) *Blastomeryx gemmifer* Cope, genotypic species

From Colorado

Merycodus gemmifer COPE, 1874, Bull. U. S. Geol.-Geog. Surv. Terr., Ser. I, No. 1, p. 22; 7th Ann. Rept. U. S. Geol.-Geog. Surv. Terr. for 1873 (Hayden), p. 531.

Blastomeryx gemmifer COPE, 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, p. 350 (mentions only). SCOTT, 1890, Bull. Mus. Comp. Zool., XX, p. 76. MATTHEW, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 124, Fig. 17; 1908, ibid., XXIV, p. 544; 1924, ibid., L, p. 195.

GENOTYPE.—Left m_3 . A.M.8301 From Pawnee Creek, Colorado.
Cope Collection, 1873.
This paper, *Fig. 23*.

Tooth is worn. Anteroposterior diameter measures 13 mm.

REFERRED.—Left ramus with A.M.9449 From west of Pawnee Buttes, 1901.
 p_2-m_3 . (w++) Figured by Matthew, 1904,
Fig. 17.

(For "associated" skeletal elements, see Limb Section, page 248.)

(8a) *Blastomeryx gemmifer medius* (Matthew)

From Sheep Creek, Sioux County, Nebraska

Blastomeryx medius MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 195, Fig. 57.

TYPE.—Partial left ramus with A.M.18955 From Stonehouse Draw, 1922.
 p_2-m_3 . (M+) Figured by Matthew, 1924,
Fig. 57.

(As seen in F:A.M.31389, diastema shorter than in New Mexican 31399.)

REFERRED.—

Left ramus with diastema, F:A.M.31389 From Stonehouse Draw, 1933.
 p_2-p_3 alveoli, p_4-m_3 . (w)

Partial left maxilla, dp^4-m^1 . A.M.18957B From Stonehouse Draw, 1922.

Left ramus with diastema, F:A.M.32831 From Greenside Quarry, 1935.
 p_2-p_4 alveoli, m_1-m_3 . (M+)

Left fragment, m_2-m_3 . (M) F:A.M.32831A From Greenside Quarry, 1935.

Left p_2-p_4 . (M++) F:A.M.32832 From Greenside Quarry, 1935.

Left dp_2-m_3 . F:A.M.32832A From Greenside Quarry, 1935.

(8aa) Var.

(/ps heavier)

(Locality in question; not cited in Table I)

Right ramus with diastema, A.M.22388 From Ashbrook Pasture,
 p_2 alveolus and p_3-m_3 . (w) Sheep Creek channel bed,
1927.

Right fragment with p_2-p_3 A.M.22388A From Ashbrook Pasture,
alveoli and p_4-m_3 . (w) Sheep Creek channel bed,
1927.

Immature partial left ramus with dp_2-m_1 .	A.M.22388B	From Ashbrook Pasture, Sheep Creek channel bed, 1927. This paper, <i>Fig. 3</i> .
Palate with p^3-m^3 . (M+)	A.M.21549	From <i>Aphelops</i> Draw, 1925. This paper, <i>Fig. 23A</i> .
Partial right maxilla with p^4-m^2 . (w)	A.M.22472	From Ashbrook Pasture, 1927.
Left p_2-m_2 . (w+) (Larger.)	F.A.M.31572	From W. Sinclair Draw, Channel C, 1935.

QUESTIONABLY REFERRED FROM ANTELOPE CREEK (3 Miles South and 8 Miles West
of Hay Springs, Dawes County), COLLECTED BY JOHNSON, MEADE AND
ASSOCIATES, 1933.—

Right fragment with p_3 (br.)- m_3 (br.). (w+)	N.S.M.7-27-11-33
Left fragment, m_1-m_3 . (w+)	N.S.M.8-27-11-33
Left fragment, m_2-m_3 . (M)	N.S.M.9-27-11-33
Left fragment, m_2-m_3 . (w+)	N.S.M.10-27-11-33
Left fragment with p_3-p_4 .	N.S.M.11-27-11-33
Left fragment, m_2-m_3 . (M)	N.S.M.15-27-11-33
Detached left m_2 , right m_1 .	N.S.M.15-27-11-33
Etc. ramal fragments.	
Partial right maxilla with p^4-m^3 . (M)	N.S.M.4-27-11-33
Partial left maxilla with m^1 - m^3 . (w)	N.S.M.5-27-11-33
8 detached upper molars.	N.S.M.15-27-11-33
Large C/.	N.S.M.15-27-11-33

FROM SAME LOCALITY, COLLECTED BY MORRIS F. SKINNER, 1934. —

Right p_3-m_2 . (w)	N.S.M.1-12-7-34
Left p_3-m_2 . (w++)	N.S.M.2-12-7-34
Right p_3-m_3 . (w)	N.S.M.3-12-7-34
Left p_4-m_3 . (w)	N.S.M.4-12-7-34
Left m_1-m_2 .	N.S.M.6-12-7-34
Left m_3 .	N.S.M.7-12-7-34
Left m_2-m_3 .	N.S.M.8-12-7-34
Left m_1-m_3 .	N.S.M.9-12-7-34

Three Cs/.	N.S.M.10-, 11- and 12-12-7-34
Left maxilla with p^4-m^3 .	N.S.M.13-12-7-34
Right maxilla with m^2-m^3 .	N.S.M.14-12-7-34
Dp_2-m_1 .	N.S.M.16-12-7-34 and etc. fragments.

Smaller:

Right ramus, p_2-m_2 . (M)	N.S.M.23-12-7-34	This paper, <i>Figs. 4, 4A.</i>
(m, brachyodont versus N.S.M.15-27-11-33.)		

See Limb Section, page 248.

(8b) **Blastomeryx gemmifer valentinensis**, new subspecies

From Cherry County, Nebraska

TYPE.—Partial left ramus with p_2-m_2 . (M+)	N.S.M.10-6-9-31	From Quarry A, Valentine, Cherry County.
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(8bb) (?)Var. A

From Cherry and Brown Counties, Nebraska

EXAMPLE.—Left fragment with p_2-m_2 . (M+)	F:A.M.32244	From Midway Quarry, Cherry County, 1934.
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REFERRED.—

C/.	F:A.M.32384	From Midway Quarry, Cherry County, 1934.
Left fragment with p_2-m_2 . (M+)	F:A.M.31376	From Elliot Ranch, Brown County, 1933.
(/ms heavier than in <i>B. mefferdi</i> type, F:A.M.31375.)		

(8c) **Blastomeryx gemmifer**, Var.

From Montana

EXAMPLE.—Partial right ramus with p_2-m_2 . (M+)	A.M.21356	From seven miles S. of Logan. Collected by Mook and Williams, 1925.
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TENTATIVELY REFERRED (SIZE GROUP VI) FROM THE SAME LOCALITY.—

Right fragment with p_2 alveolus and p_3-m_1 . (W++)	A.M.21357
Detached m^1 .	A.M.21366

(9) *Blastomeryx mollis* Merriam

From Nevada

Blastomeryx mollis MERRIAM, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 278, Figs. 56-58.

TYPE.— m_3 .	U.C.11565 (or ?11564)	From Virgin Valley, Nevada. Figured by Merriam, 1911, Fig. 56.
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REFERRED FROM TYPE LOCALITY.—

Anterior fragment of ramus with premolars, or ?dps.	U.C.11567	Figured by Merriam, 1911, Fig. 57.
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Fragment with " p_3 and al- veolus of p_3 ."	U.C.12609	Figured by Merriam, 1911, Fig. 58.
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John C. Merriam (p. 280) observes, "The stage of advance of this species is close to that of *B. primus* and *B. olcottii*, and it may possibly be united with one of these forms when more material is available for study."

SIZE GROUP VI.

(10) *Blastomeryx francesca*, new species

From New Mexico

TYPE.—Left fragment with m_1 — m_3 . (M)	F:A.M.31433	From Santa Fé area, 1927.
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SIZE GROUP VII.

(11) *Blastomeryx francescita*, new species

From New Mexico

TYPE.—Right fragment with m_1 (br.)— m_3 . (M)	F:A.M.31425	From Santa Cruz. This paper, <i>Fig. 23</i> .
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REFERRED.—

Right fragment with p_3 root, p_4 (br.)— m_2 (br.). (M+)	F:A.M.31397	From Santa Cruz, 1925.
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Right fragment with m_1 (br.)— m_3 . (M+)	F:A.M.31434	From S.E. of White Opera- tion, 1926.
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XXII. PARABLASTOMERYX, NEW GENUS

Frontispiece, Reconstruction c

SIZE GROUP III+ (SIZE GROUPS I AND II UNREPRESENTED).

(12) *Parablastomeryx gregorii*, new genus and species

From East Cherry County, Nebraska

GENOTYPE.—Skull, mandible, dentition (excepting Cs/) and skeletal elements (see page 249). (—M) F:A.M.31360 From Xmas Quarry, 1932. This paper, *Figs. 22, 25.*

REFERRED, COLLECTED WITH TYPE AT TYPE LOCALITY BY M. F. SKINNER AND PARTY, 1932.—

Slightly larger than type:

Skull, nearly complete, with C/—p², p⁴—m². (—M) F:A.M.31361 This paper, *Fig. 22.*
Left ramus with symphysis and p₂—m₃. (M) F:A.M.31364 This paper, *Fig. 23.*

[Note partial skull (F:A.M.33720) from Hans Johnson Quarry, of smaller size than above, referred tentatively to *Pseudoceras*.]

Type-sized:		F:A.M.
Left maxilla with p ³ —m ²	(w++)	31362
Partial mandible with symphysis, p ₂ alveolus and p ₄ —m ₃	(w+)	31363
Partial left ramus with p ₂ —m ₃	(M)	31365
Partial right ramus with p ₂ —p ₃ alveoli, p ₄ —m ₃	(M+)	31366
Left fragment, p ₃ —m ₃	(M+)	31367
Right fragment with m ₂ —m ₃	(w+)	31368

See Limb Section, page 249.

REFERRED FROM MACHÆRODUS QUARRY CHANNELS, 1934 AND 1936 (not separately cited in Table I).—

Type-sized:		F:A.M.
Left ramus with /Is—p ₂ alveoli, p ₃ —m ₃	(w+)	32914
Left m ₂ —m ₃	(M+)	32914A

Slightly larger individual:

Left ramus with diastema, p₂—p₃ broken, p₄—m₃..... (w+++)

31359

(13) (?)*Parablastomeryx galushi*, new species

From Dawes County, Nebraska

TYPE.—Partial cranium (lacking distal end of muzzle and the base of skull posterior to the last molars) with p^2-m^2 . (M+) F:B:A.M.33775 This paper, *Fig. 22A*.

Molars slightly taller-crowned and with less pronounced cingula, premolars of similar form but of slightly smaller proportions and post-/C diastema apparently slightly longer than in *P. gregorii*. Orbit anteriorly placed; indication of sabre-formed canine.

XXIIA. PSEUDOPARABLASTOMERYX, NEW SUBGENUS

SIZE GROUP VI.

(14) *P. (Pseudoparablastomeryx) scotti*, new subgenus and species

From Observation Quarry, Dawes County, Nebraska

SUBGENOTYPE.—Mandibular ramus with diastema, p_2 alveolus, p_3-m_3 (br.). (M+) F:B:A.M.33763 This paper, *Fig. 22A*.

The postsymphysial distance is equivalent to approximately 18% of the cheek-tooth series length versus 27% in *Parablastomeryx*. The proportion between the premolars and molars and between p_3 and p_4 approximates that in the latter genus. $p_2-p_4 = (17.3)$ mm., $m_1-m_3 = ((24.5))$.

The specimen equals in size *Blastomeryx francesca* and is slightly smaller and with shorter diastema than *Pseudoblastomeryx advena*.

REFERRED.—

	F:B:A.M.
Right ramus with symphysis, p_2 alveolus and p_3-m_2 (br.)....	(M+) 33768
	<i>Fig. 22A</i>
Right m_1-m_3	(M) 33769
	<i>Fig. 22A</i>
Left partial ramus with p_4 alveolus and m_1-m_3	(M+) 34026
Right maxilla, p^2-m^2	(W) 33767

A questionably referred metacarpus measures 49 mm.; a metatarsus, 66 mm. (See Limb Section, page 249.)

Limb Elements Representing the Above Late Tertiary Blastomerycine Genera and Species

Figures 23B and (in part) 25, 25A, 25B

The Late Tertiary Blastomerycine remains include skeletal elements associated with jaws or dentitions only in the case of *Parablastomeryx gregorii*. A partial skeleton unassociated with the dentition is exemplified by a specimen from New Mexico, F:A.M.31729, in which the laterals are represented by a lone third phalanx. The *Parablastomeryx* skeleton is notable for the large size of the limb elements, and interesting in showing the fusion of the proximal splints and the detached, well-preserved distal splints in the fore and lateral phalanges in both fore and hind feet. Additional associated remains are available in the case of the Lower Miocene *Pseudoblastomeryx* forms (see following section). The associated limb elements of *Parablastomeryx gregorii*, the metapodials tentatively referred to certain other Late Tertiary forms, and examples of the better represented Middle Tertiary *Problastomeryx* and *Pseudoblastomeryx* limbs, are illustrated on adjoining plates [Figs. 23B and (in part) 25, 25A, 25B].

The following Late Tertiary genera and species are represented by limb elements; where the association is definite, the species are starred. The numbers preceding species are the same as used above.

(Compare species summary, page 224; for measurements see combined Middle and Late Tertiary Blastomerycini and Merycodontini measurement table, pages 448-450; and compare Table IV, page 190.)

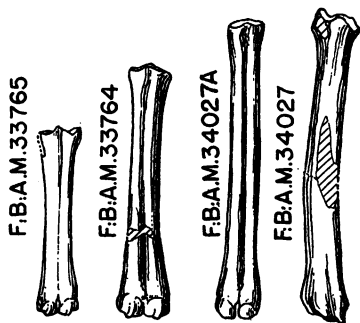


FIG. 23B. F:B:A.M.33765 and 33764, *Pseudoparablastomeryx scotti*, n.subg. and sp., ref., right metacarpus and left metatarsus; and F:B:A.M.34027A and 34027, ?Blastomerycine species, right metatarsus and radius, from the Late Tertiary of Dawes County, Nebraska.

× $\frac{1}{2}$. (See page 249.)

SUMMARY OF GENERA, SUBGENERA AND SPECIES REPRESENTED BY LIMB ELEMENTS

XX. *Longirostromeryx*, NEW GENUS, REFERRED

LIMB SIZE GROUP III-. (TOOTH SIZE GROUPS III TO V.)

- (2) *L. merriami*, n.g. and sp., vars. A and B, referred, from Brown and Cherry Counties, Nebraska.
- (2a) *L. serpentis*, n.sp., referred, from Sioux County, Nebraska.
- (3) (?) *L. novomexicanus*, n.sp., referred, from New Mexico.

LIMB SIZE GROUP IV. (TOOTH SIZE GROUPS III TO V.)

- (4) *L. clarendonensis*, n.sp., referred, from Texas.
- (5) (?) *L. blicki*, n.sp., referred, from New Mexico. This paper, *Fig. 25A* (F:A.M. 31729).

Species (1) and (4a) are not represented by limbs.

XXI. *Blastomeryx* COPE

LIMB (-TOOTH) SIZE GROUP IV.

- (6) *B. elegans* Matthew and Cook, referred, from Sioux County, Nebraska. This paper, *Fig. 25A* (A.M.22474D and 14132E).

(TOOTH SIZE GROUP V.)

- (7) *B. mefferdi*, n.sp., referred, from Brown County, Nebraska.
- (8) *B. gemmifer* Cope, referred, from northeastern Colorado.
- (8a) *B. gemmifer medius* (Matthew), referred, and var., from Sioux and Dawes Counties, Nebraska. This paper, *Fig. 25A* (A.M.14132 and F:A.M. 31901).

Species (8b), (8c), (9), (10) and (11) are not represented by limbs.

LIMB SIZE GROUPS VII AND VIII.

- (11x) Three ?*Blastomeryx* species, from Cherry, Dawes and Sioux Counties, Nebraska. This paper, *Fig. 23B* (F:B:A.M.34027 and A); *Fig. 25A* (A.M.14131).

XXII. *Parablastomeryx*, NEW GENUS

LIMB SIZE GROUP I. (TOOTH SIZE GROUP III+.)

- *(12) *P. gregorii*, n.g. and sp., from east Cherry County, Nebraska. This paper, *Figs. 25, 25B* (F:A.M.31360).

Species (13) is not represented by limbs.

XXIIA. *Pseudoparablastomeryx*, NEW SUBGENUS

LIMB SIZE GROUP IX. (TOOTH SIZE GROUP VI.)

- (14) *P. scotti*, n.subg. and sp., questionably referred, from Dawes County, Nebraska. This paper, *Fig. 23B* (F:B:A.M.33765 and 33764).

DETAILED LISTS OF LIMB ELEMENTS OF ABOVE GENERA AND SPECIES

LIMB SIZE GROUP III—.

(2) *L. merriami*, n.g. and sp., vars. A and B, referred

From Brown and Cherry Counties, Nebraska

Left metacarpus.	F:A.M.32247	From Burge Quarry, 1935.
Left metatarsus.	F:A.M.31954	From Quinn Quarry, 1927.

(2a) *L. serpentis*, n.sp., referred

From Sioux County, Nebraska

Left metatarsus.	A.M.22474E	From Quarry A, 1921.
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(3) (?) *L. novomexicanus*, n.sp., referred

From New Mexico

Right metatarsus.	F:A.M.31723	From San Ildefonso, 1927.
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LIMB SIZE GROUP IV.

(4) *L. clarendonensis*, n.sp., referred

From Texas

Left metatarsus.	F:A.M.32461	From Clarendon, 1935.
Portion of right humerus, left radius, distal one-half metacarpus, etc.	F:A.M.32461A,B,C	

(5) (?) *L. blicki*, n.sp., referred

From New Mexico

Skeletal elements: distal one-half right humerus, right radius, carpus, metacarpus (br.), distal one-half right and one-third left tibia, right and left tarsi, right and left metatarsi, four 1st, four 2d and two 3d phalanges, one lateral 3d phalanx.	F:A.M.31729	From Cuyamungue, 1930. This paper, <i>Fig. 25A</i> (left metatarsus).
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(6) *B. elegans* Matthew and Cook, referred

From Sioux County, Nebraska

Left metacarpus, 110 mm.	A.M.22474D	From Quarry A, 1921. This paper, <i>Fig. 25A</i> .
Right metatarsus, 120 mm.	F:A.M.31899	From E. Sinclair Draw, 1933.
Left metatarsus.	F:A.M.31900	From W. Sinclair Draw, 1933.

Three left and one right metatarsi.	A.M.14132B-E	From Snake Creek beds, 1908. This paper, <i>Fig. 25A</i> (A.M. 14132E).
Right metacarpus.	F:A.M.32479I	From Echo Quarry, 1935.
Right radius.	F:A.M.31938B	From Echo Quarry, 1935.

(7) *B. mefferdi*, n.sp., referred

From Brown County, Nebraska

Right metatarsus.	F:A.M.31953	From Devil's Gulch, Horse Quarry, 1933.
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(8) *B. gemmifer* Cope, referred

From Northeastern Colorado

Skeletal elements: distal one-half tibia, tarsus and proximal two-thirds metatarsus.	A.M.9449	From west of Pawnee Buttes, 1901.
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(See "associated" left ramus, page 239.)

Distal two-thirds right tibia.	F:A.M.31649	From 2 miles west of Mastodon Quarry, 1932.
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(8a) *B. gemmifer medius* (Matthew), referred, and var.

From Sioux and Dawes Counties, Nebraska

Right radius, 113 mm.	F:A.M.31898	From W. Sinclair Draw, 1933.
Right metatarsus.	F:A.M.31901	This paper, <i>Fig. 25A</i> .
Right and left (110 mm.) metacarpi.	A.M.14132	From Snake Creek beds, 1908. This paper, <i>Fig. 25A</i> (left).
Left (125 mm.), right and three partial metatarsi.	A.M.14132	

From Antelope Creek, Dawes County (reference questioned):

Astragalus.	N.S.M.17-12-7-34	Collected by Morris F. Skinner, 1934.
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Distal ends of three tibiae, etc.	N.S.M.18-, 19- and 20-12-7-34	
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LIMB SIZE GROUPS VII AND VIII.

(11x) Three ?Blastomerycine species

(May represent distinct genera)

(a) LIMB S.G. VII.

From Cherry County, Nebraska

Left metatarsus, 79 mm.	F:A.M.32195	Xmas Zone Quarry, 1936.
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From Dawes County, Nebraska

Right radius and metatarsus, 77 mm. F:B:A.M.34027 and A Observation Quarry, 1936. This paper, *Fig. 23B*.
(Doubtful; somewhat longer-proportioned than in *Pseudoparablastomeryx scotti*, ref.) (Not included in specimen count.)

(b) LIMB S.G. VIII.

From Sioux County, Nebraska

Right metatarsus. A.M.14131 From Snake Creek beds, 1908. Figured by Matthew and Cook, 1909, *Fig. 25*, under (?) *Merycodus*, sp. indesc.; this paper, *Fig. 25A*.
(Not cited in Table I.)

LIMB SIZE GROUP I.

(12) *P. gregorii*, new genus and species

From East Cherry County, Nebraska

GENOTYPE (in part).— F:A.M.31360 From Xmas Quarry, 1932. This paper, *Figs. 25, 25B*.
Skeletal elements including both scapulæ, humeri, radii and ulnæ, carpi, metacarpi, splints and phalanges, pelvis, both femora, one patella, both tibiæ, tarsi and metatarsi, four lateral splints with phalanges.

For assembled metacarpus and metatarsus, see *Fig. 25B*. The three pairs of second and third lateral phalanges associated with the specimen witness the presence of these elements in both manus and pes.

(Note skull and mandible, page 243. This paper, *Fig. 22*.)

REFERRED FROM XMAS QUARRY, 1932.—

Distal four-fifths right humerus. F:A.M.31955A
Right femur. F:A.M.31955
Distal two-thirds left tibia. F:A.M.31955B

LIMB SIZE GROUP IX.

(14) *P. (P.) scotti*, n.subg. and sp., questionably referred

From Observation Quarry, Dawes County, 1936

Distal one-third left humerus and right radius (br.). F:B:A.M.33766A and 33766
Right metacarpus, 49 mm. F:B:A.M.33765 This paper, *Fig. 23B*.
Left metatarsus, 66 mm. F:B:A.M.33764 This paper, *Fig. 23B*.

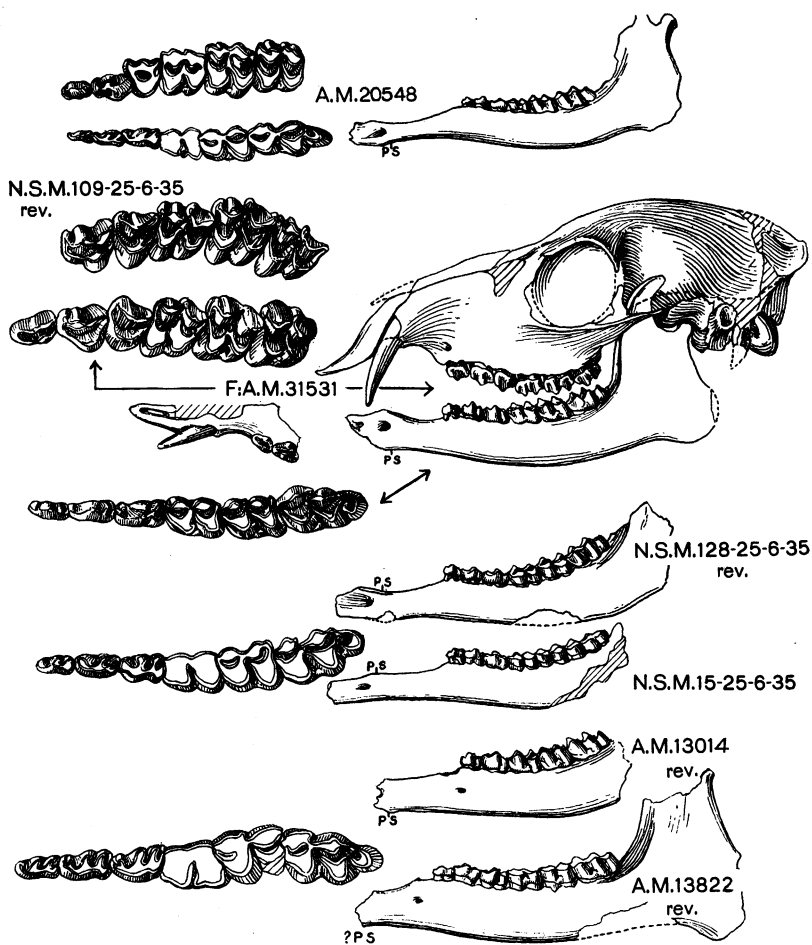


FIG. 24. Blastomerycini from the Middle Tertiary of Nebraska, Wyoming and South Dakota, skull, mandibular and maxillary dentitions compared. (See pages 254, 256-259.)

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. PS, posterior border symphysis.

A.M.20548, *Machæromeryx tragulus* Matthew, genotype (in part), from Sioux County, Nebraska (Upper Harrison).

F.A.M.31531, *Pseudoblastomeryx falkenbachii*, n.subg. and sp., ref., from Lusk, Wyoming.

N.S.M.109-25-6-35 (rev.), 128-25-6-35 (type, rev.) and 15-25-6-35 (p_2 from 96-25-6-35), *Pseudoblastomeryx schultzei*, n.sp., from Morrill County, Nebraska.

A.M.13014, *Pseudoblastomeryx advena* (Matthew), type, rev., from the Rosebud, South Dakota.

A.M.13822, *Problastomeryx primus* (Matthew), subgenotype (in part), rev., from the Upper Rosebud, South Dakota. (See also Fig. 25A [metatarsus].)

(B) MIDDLE TERTIARY SECTION

Subfamily 10.—*Longirostromerycinae* (cont.)XXIII. *MACHÆROMERYX* MATTHEWSubfamily 11.—*Parablastomerycinae* (cont.)XXIV. *PROBLASTOMERYX*, NEW SUBGENUSXXV. *PSEUDOBLASTOMERYX*, NEW SUBGENUS

Figures 24 and (in part) 3; Skeletal Elements (in part) 25A

Statement

Problastomeryx and *Pseudoblastomeryx*, new subgenera, are erected to take several ostensibly hornless forms with large upper canines, from the Lower Miocene. The specimens differ from the more average of the Late Tertiary remains of the preceding section in their greater tendency to shorter-proportioned diastemata, lower crowns and larger-proportioned premolars, in this lying perhaps nearest to the genus *Parablastomeryx*. The eight here enumerated species seem to be divisible between a longer- and a shorter-limbed group: *Problastomeryx* with metapodials less elongate than in *Parablastomeryx*, and *Pseudoblastomeryx* with metapodials of noticeably smaller size. The latter group is nicely exemplified by specimens secured in northeastern Wyoming by C. Falkenbach and E. DeGroot, including a beautifully preserved skull and jaws (*P. falkenbachii*, Fig. 24). The limbs are never abbreviated as is characteristic of *Dremotherium* and *Tragulid*. *Pseudoblastomeryx* is exemplified further in the slightly smaller forms, *P. advena* (Matthew) and *P. schultzi*, n.sp. Remains of the latter were recently discovered in Morrill County by C. Bertrand Schultz and made available for study through the kindness of Professor Barbour. The p^3 inner root in the species *P. falkenbachii* is prominent as in *Parablastomeryx gregorii*, versus the constricted, rounded border in (?) *Longirostromeryx blicki*.

Problastomeryx and *Pseudoblastomeryx* specimens previously have been used in large measure to characterize *Blastomeryx* Cope, based (pp. 217, 238) on the Late Tertiary Pawnee Creek m_s. In the absence of

the characteristic premolar portion of the series, doubt may arise as to the allocation of small Lower Miocene specimens between *Blastomeryx*¹ and *Leptomeryx-Hypertragulus*.

The diminutive slender-limbed and less brachyodont-tending *Machæromeryx* is more suggestive of a specialized species from the Mio-Pliocene than of the primitive forms of this section. There is the possibility that *M. tragulus* Matthew may prove to have borne horns and perhaps to have been nearer allied to the Aletomerycini than to the Blastomerycini.

As observed above, the Lower Miocene Blastomerycine limbs actually may be of moderately elongate proportions, though not as elongate as in *Parablastomeryx gregorii*, or they may be of shorter proportions (*Pseudoblastomeryx falkenbachii*, *P. advena* and *Machæromeryx tragulus*), compared to their respective dentitions and to the hypothetically normal condition in *Blastomeryx* and in the Merycodontini. The metacarpi of *P. falkenbachii* and *P. advena* retain the splint bones. It is presumed that in all six of the Lower Miocene species, vestiges of the proximal external and internal splints (the same tending to be coössified with the head of the metacarpals) and their distal extremities and phalanges were retained in the manus and occasionally in the pes. The later *P. gregorii* exhibits detached remnants of the laterals and their phalanges in the manus and of lateral phalanges only in the pes. Some slight evidence as to the possible condition in *Blastomeryx* is seen in the lone phalanx associated with the partial skeletal elements referred to the New Mexican (?) *Longirostromeryx blicki*. [A further example may be represented by the Pawnee Creek, Colorado, metacarpus with lateral phalanges (A.M.9475) heretofore referred to *M. (Ramoceros) osborni*.] The retention of the laterals is evidenced in both *Aletomeryx gracilis* and in *A. marshi*, as thereunder noted. It may be recalled that William D. Matthew (1908) reported the Lower Miocene Blastomerycini then known to him to be furnished with formed fore and hind cannon bones, apparently complete lateral digits in the fore limb and proximal splints in the hind limb and a metatarsus shorter and more robust than in *Merycodus*.

¹ Harold J. Cook (1934, *The American Midland Naturalist*, XV, No. 2, p. 157), figures and describes three new species from the Lower Miocene which he refers to *Blastomeryx* Cope. The species are based on certain interesting fragments from the Harrison Beds. *B. pristinus*, type m², Plate III, Fig. 4, and *B. cursor*, type p¹-m³ and referred ms, Plate IV, Figs. 4 and 5, are apparently of *P. schultzei* size. *B. tantillus*, type m₂-m₃ and two ms/, etc., Plate III, Figs. 5 and 6, have the dimensions of diminutive *Leptomeryx-Hypertragulus*. The large size of the premolars in the non-hypsodont *Merycodus prodromus* Cook, type palate from the Harrison Beds, Plate III, Fig. 7, tends to recall *B. cursor* rather than *Merycodus*.

Summary of Lower Miocene Species

(A) WITH MODERATE-PROPORTIONED LIMBS.

SIZE GROUP VII+.

- (1) *Machæromeryx tragulus* Matthew, genotypic species, from six miles northeast of Agate, Nebraska (Upper Harrison).

GENOTYPE.—Portions of skull, mandible and skeleton, A.M.20548. This paper, *Fig. 24*.

(B) WITH LONG-PROPORTIONED LIMBS.

SIZE GROUP III. [LIMBS, SIZE GROUPS III- TO IV.]

- (2) *Problastomeryx olcotti* (Matthew), 1908, from the Harrison, Lusk, Wyoming.

TYPE.—Left ramus, A.M.13224 (in part).

[Dentition near, limbs shorter than *P. primus*; length tibia near, metatarsus short as compared with the much larger-toothed *Aleto-meryx marshi*.]

- (2a) *Problastomeryx* species, from Dawes County, Nebraska.

EXAMPLE.—Right fragment with m_1 - m_3 , F.B:A.M.32871.

- (3) *Problastomeryx primus* (Matthew), 1908, subgenotypic species, from the Upper Rosebud, South Dakota.

SUBGENOTYPE.—Partial skull, both rami and skeletal elements, A.M. 13822. This paper, *Figs. 24* (ramus), *25A* (left metatarsus).

[Limbs slightly larger (tibia actually longer) but teeth relatively much smaller than *A. marshi*.] Compare A.M.13824, page 624.

(AA) WITH MODERATE-PROPORTIONED LIMBS ("PSEUDOBLASTOMERYCINÆ").

SIZE GROUP V.

- (4) *Pseudoblastomeryx falkenbachi*, n.subg. and sp., from Lusk, Wyoming.

SUBGENOTYPE.—Partial skull and skeletal elements, F:A.M.31530.

This paper, *Fig. 25A* (right metacarpus and metatarsus).

[p^2 - p^3 widely different from *P. olcotti*, as seen in referred muzzle.]

SIZE GROUP V. [LIMBS, SIZE GROUP VI.]

- (5) *Pseudoblastomeryx advena* (Matthew), 1907, from the Rosebud, South Dakota.

TYPE.—Partial right ramus, A.M.13014. This paper, *Fig. 24*.

- (5a) (?) *Pseudoblastomeryx advena*, smaller var., from the Upper Rosebud, South Dakota.

EXAMPLE.—Portions of skeletal elements, A.M.13823. This paper, Fig. 25A (right metatarsus).

- (6) *Pseudoblastomeryx schulzi*, n.sp., from Bridgeport, Morrill County, Nebraska.

TYPE.—Right ramus, N.S.M.128-25-6-35. This paper, Fig. 24.

SIZE GROUP VI. (LIMBS UNKNOWN.)

- (7) (?) *Pseudoblastomeryx marsa*, n.sp., from west Cherry and Dawes Counties, Nebraska.

TYPE.—Immature right ramus, F.A.M.31354. This paper, Fig. 3.

Detailed Lists of Middle Tertiary Types,
Referred Specimens (Including Limbs) and Synonymy

Machæromeryx, total available listed specimens, 1; *Problastomeryx*, 12; *Pseudoblastomeryx*, 53.

SIZE GROUP VII+.

- (1) *Machæromeryx tragulus* Matthew, genotypic species

From Upper Harrison Beds, Nebraska

Machæromeryx tragulus MATTHEW, 1926, Amer. Mus. Novitates, No. 215, p. 1, Figs. 1, 2.

GENOTYPE.—Palate with large Cs/, p²-m³ and right one-half base of skull; mandible with p₂-m₃. (M+)

A.M.20548

From 6 miles N.E. of Agate, 1923.

Figured by Matthew, 1926, Figs. 1, 2; this paper, Fig. 24.

Limbs of Size Group VII+:

Right and left scapulæ, humeri, ulno-radial, metacarpal, phalanges, partial right and left femora, distal two-thirds left tibia, left and distal one-half

right metatarsus, calcaneum and astragalus, several carpals and tarsals, three 1st, two 2d and two 3d phalanges, 7 cervical, 9 dorsal and 4 lumbar vertebrae, pelvis and sacrum.

Note: Length /ps and diastema moderate; length /ps (12.3 mm.) equaling 63% of diastema length (19.5 mm.); /ps tending simple, p₁ broadly open inwardly.

SIZE GROUP III.

(2) *Problastomeryx olcottii* (Matthew)

From the Harrison, Lusk, Wyoming

Premolars relatively large, symphysis missing, Cs/ large

Blastomeryx olcottii MATTHEW, 1908, Bull. Amer. Mus. Nat. Hist., XXIV, p. 543, Figs. 2 (of C/), 3 (of ramus), 7 (of tarsus and metatarsus) and 11 (of upper dentition).

TYPE.—Left ramus without symphysis, with p ₂ alveolus, p ₂ -m ₃ . (M+)	A.M.13224 (in part)	From 9 miles S.E. of Lusk, 1907.
Teeth slightly worn.		Figured by Matthew, 1908, Fig. 3.

REFERRED FROM TYPE LOCALITY, 1907 (at least three individuals held under same number with type).—

Left p ₂ -m ₃ . Unworn.	A.M.13224A(in part)
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Large unworn C/.	A.M.13224	Figured by Matthew, 1908, Fig. 2.
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C/ (br.), unworn.	A.M.13224
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Worn right maxilla with p ⁴ -m ³ , and possibly associated right ramal fragment with p ₄ -m ₃ .	A.M.13224	Figured by Matthew, 1908, Fig. 11 (in part).
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REFERRED LIMB ELEMENTS.—

Matthew (1908, p. 544) notes under A.M.13224, "upper and lower jaws, hind limbs and feet," and (A), "lower jaw and hind foot of a younger individual..." A reëxamination of these limbs, from nine miles southeast of Lusk, indicates the presence of at least three individuals, all of Size Groups III—to IV, and large for the jaws.

(1) Moderately large:

Left metatarsus, 127 mm.	A.M.13224
--------------------------	-----------

(2) Moderate:

Right tibia, 163 mm., tarsus and metatarsus, one 1st, one 2d and one 3d phalanx.	A.M.13224	Figured by Matthew, 1908, Fig. 7.
--	-----------	-----------------------------------

(3) Moderately small:

Right metatarsus, one 1st and one 2d phalanx, etc. fragments.	A.M.13224A(in part)
---	---------------------

(2a) *Problastomeryx* species

From Dawes County, Nebraska

EXAMPLE.—Right fragment F:B:A.M.32871 From B Quarry, Antelope
with m_1 - m_3 . (M+) Valley, 1935.
 m_3 = 12.3 mm.
(So far as visible, resembles *P. primus*.)

INDETERMINATE SPECIES FROM SAME LOCALITY.—

Right fragment with m_1 - F:B:A.M.32874 1935.
 m_3 . (M+)

(Larger than *Parablastomeryx* and smaller than *Barbouromeryx trigonocorneus*.)

(3) *Problastomeryx primus* (Matthew), subgenotypic species

From the Upper Rosebud, South Dakota

Shortness of diastema indicated in broken symphysis. Premolars relatively large, molars with both types of folds and columns. Cs/ seen in associated remains. Limbs relatively large and approximating *Aletomeryx marshi*.

Blastomeryx primus MATTHEW, 1908, Bull. Amer. Mus. Nat. Hist., XXIV, p. 543, Figs. 1, 5 and (in part) 10, 11.

SUBGENOTYPE.—Skull and both A.M.13822 From 1 mile W. of Horse
rami with worn denti- Creek, 1907.
tion (including broken C/ Figured by Matthew, 1908,
right), and associated Figs. 1, 5 and (in part) 10, 11;
skeletal elements. this paper, *Fig. 24* (ramus).

Limbs of Size Group III:

Right radius, right carpus,
right and partial left
femur, left and distal one-
half right tibia, left calca-
neum, left and right as-
tragali and tarsals, left
and distal one-half right
metatarsus, three 1st, two
2d and one 3d phalanges,
etc. fragments.

This paper, *Fig. 25A* (left
metatarsus).

REFERRED FROM PORCUPINE BUTTE, 1906.—

Partial left ramus with A.M.13016
 m_1 - m_3 .

(Atlas and scapula reported but not found.)

SIZE GROUP V.

(4) *Pseudoblastomeryx falkenbachii*, new subgenus and species

From Lower Miocene, Lusk, Wyoming

Premolars small and limbs very small relative to *P. olcottii*

SUBGENOTYPE.—Partial skull F:A.M.31530 From 18 miles S.E. of Lusk,
with C/alveolus and p^2-m^3 , 1933.
and skeletal elements (see
below).

Length of limbs approximates Size Group v, Merycodontini:

Left humerus with head missing, greater portion left ulno-radius, right manus: metacarpus, nearly complete internal and proximal portion of external laterals, one complete and one proximal half 1st phalanx; left metacarpus, left and distal third right femur, right and proximal fourths left tibia, left tarsus, metatarsus, two 1st, two 2d and one 3d phalanges, pelvis, etc. fragments.

F:A.M.31530 This paper, *Fig. 25A* (right metacarpus and metatarsus).

REFERRED.—

Well-preserved skull and mandible with C/ $-m^3$ and p_2-m_3 . (w) F:A.M.31531 From 20 miles S.E. of Lusk, 1935.
This paper, *Fig. 24*.

Left fragment with p_4 (br.)- m_3 . F:A.M.31530A From Little Muddy Creek, 1933.

VERY QUESTIONABLY REFERRED.—

Right and left rami with diastema and p_2-m_3 . (w) F:A.M.31532 From 12-15 miles S. of Lusk, 1932.
(Diastema short, size (Size Group iv) larger than above specimens and nearly as large as *P. olcottii*.)

Right ramus with p_3 (br.)- m_3 . (w) F:A.M.32849 From 10 miles S.E. of Lusk, 1935.

(5) **Pseudoblastomeryx advena** (Matthew)

From the Rosebud, South Dakota

Premolars large; shortness of diastema indicated in broken symphysis

Blastomeryx advena MATTHEW, 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 219;
1908, *ibid.*, XXIV, p. 543, Figs. 4, 6 and (in part) 12, 13.

TYPE.—Partial right ramus with p_1-m_1 . (M)	A.M.13014	From west of Porcupine Creek. Figured by Matthew, 1908, Fig. 4; this paper, <i>Fig. 24</i> .
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QUESTIONABLY REFERRED (larger than type, limbs smaller than *P. falkenbachii*):

Muzzle with enlarged Cs /, p^1 's and p^2 's, and associated skeletal elements (wrongly reconstructed).	A.M.13015	From Porcupine Creek, 1906. Figured by Matthew, 1908, Fig. 6.
--	-----------	---

Limbs of Size Group VI:

Partial right scapula, dis-
tal end left humerus,
proximal half right radius,
right and left partial ul-
næ, right and distal one-
half left metacarpus, and
proximal two-thirds left
femur, left calcaneum and
astragalus, one tarsal, left
metatarsus, one 1st and
one 2d phalanx.

Figured by Matthew, 1908,
Figs. 12 and 13 (in part);
this paper, *Fig. 25A* (right
metacarpus and left meta-
tarsus).

Matthew observes that A.M.13015 "...shows the structure of manus and pes
almost identical with that of *B. gemmifer*."

(5a) (?) **Pseudoblastomeryx advena**, Smaller Var.

From the Upper Rosebud, South Dakota

EXAMPLE.—Distal third right tibia, right metatarsus, two 1st, one 2d and two 3d pha- langes.	A.M.13823	From 1 mile W. of Horse Creek, 1907. This paper, <i>Fig. 25A</i> (right metatarsus).
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(6) *Pseudoblastomeryx schultzi*, new species

From Quarry 1, Bridgeport, Morrill County, Nebraska

N.S.M.

TYPE.—Right ramus with symphysis and p_2 - m_3 (M+) 128-25-6-35
Fig. 24

REFERRED.—

Type-sized:

Left ramus with symphysis, p_2 alveolus and p_3 - m_3 (M+) 127-25-6-35
 Left ramus with symphysis, p_2 alveolus and p_3 - m_3 (w) 15-25-6-35
Fig. 24
 Left ramus with diastema and p_3 - m_3 (w) 96-25-6-35
 Left ramus with p_3 - m_3 (w) 105-25-6-35
 Left fragment with p_2 alveolus and p_3 - m_3 (w+) 60-, 61-6-7-34
 Right fragment with symphysis and p_2 - p_4 (M+) 16-25-6-35
 Right fragment with p_3 - m_3 (w+) 100-25-6-35
 Right fragment with dp_4 - m_3 59-6-7-34
 Right maxilla with p^2 - m^3 (M) 109-25-6-35
Fig. 24
 Left fragment with m^1 (br.)- m^2 (w) 31-25-6-35

Slightly larger than type:

Right fragment with p_3 - m_3 (M+) 17-25-6-35
 Right fragment with p_3 - m_3 (br.)..... (M++) 77-25-6-35
 Right fragment with p_2 alveolus and p_3 - m_3 (M++) 113-25-6-35
 Right fragment with diastema, p_2 alveolus and p_3 - m_1 ... (M++) 102-25-6-35

Limbs, Size Group VI:

(The metapodial length equals, but the metapodials are slightly slenderer-proportioned than *P. advena*.)

N.S.M.

Distal portion right humerus..... 75-25-6-35
 Right metacarpus (80 mm.)..... 116-25-6-35
 Right metatarsus (98 mm.)..... 117-25-6-35
 Two calcanea..... 70- and 71-25-6-35
 Eight astragali..... 38-, 39-, 73-, 74-, 137-25-6-35,
 25-6-34, 6-7-34, 6-7-34

Five 1st, one 2d and three 3d phalanges; one tarsal.

QUESTIONABLY REFERRED (from 6 mi. S.W. of Bridgeport, S. R. Sweet, collector, 1932).—

Partial skull and left ramus with dp_3 and m_1^1 , part of right ramus, two whole and three broken phalanges.....

A.M.27762

SIZE GROUP VI.

(7) (?) *Pseudoblastomeryx marsa*, new species

From West Cherry and Dawes Counties, Nebraska

TYPE.—Immature right ramus F:A.M.31354 From 1 mile west of *Aletomeryx* Quarry, 1934.
 with dp_4-m_3 (br.) and germs of p_1-p_4 . This paper, Fig. 3.

TENTATIVELY REFERRED.—

From B Quarry, Antelope Valley, Dawes County, collected by Ted Galusha, 1935:

Right fragment, p_4-m_3 . (w) F:B:A.M.32870
 Two left m_3 s. F:B:A.M.32870A and B
 Right fragment with m_1 F:B:A.M.32870D
 (br.)- m_3 . (-m)
 (Size slightly larger.)
 Left m_2-m_3 . (m) F:B:A.M.32870C
 (Size smaller.)

Summary Re Limb Elements of Above Blastomerycines

Figure 25A (in part)

Some six of the above Middle Tertiary species seem to be represented by limb elements. In four of these the limbs are in definite association.

(Compare limb elements of the Late Tertiary species, summary, page 246; and for measurements see combined Middle and Late Tertiary Blastomerycini and Merycodontini measurement table, pages 448-450.)

RÉSUMÉ OF REPRESENTED GENERA, SUBGENERA AND SPECIES

(Details are given under the respective forms, see preceding pages.)

* = elements associated with dentitions

(A) WITH MODERATE-PROPORTIONED LIMBS.

XXIII. *Machæromeryx* MATTHEW

LIMB (-TOOTH) SIZE GROUP VII+.

*(1) *M. tragulus* Matthew, from six miles northeast of Agate, Nebraska (Upper Harrison).

(B) WITH LONG-PROPORTIONED LIMBS.

XXIV. *Problastomeryx*, NEW SUBGENUS

LIMB SIZE GROUPS III-TO IV. (TOOTH SIZE GROUP III.)

- (2)
- P. olcotti*
- (Matthew), from the Harrison, Lusk, Wyoming.

LIMB (-TOOTH) SIZE GROUP III.

- *(3) *P. primus* (Matthew), subgenotypic species, from the Upper Rosebud, South Dakota. This paper, *Fig. 25A* (A.M.13822).
Species (2a) is not represented by limbs.

(AA) WITH MODERATE-PROPORTIONED LIMBS.

XXV. *Pseudoblastomeryx*, NEW SUBGENUS

LIMB (-TOOTH) SIZE GROUP V.

- *(4) *P. falkenbachii*, n.subg. and sp., from Lusk, Wyoming. This paper, *Fig. 25A* (F:A.M.31530).

LIMB SIZE GROUP VI. (TOOTH SIZE GROUP V.)

- *(5) *P. advena* (Matthew), from the Rosebud, South Dakota. This paper, *Fig. 25A* (A.M.13015).
(5a) (?) *P. advena*, smaller var., from the Upper Rosebud, South Dakota. This paper, *Fig. 25A* (A.M.13823).
(6) *P. schultzi*, n.sp., from Bridgeport, Morrill County, Nebraska.
Species (7) is not represented by limbs.

FIGS. 25 AND 25A. Dromomerycini, Blastomerycini and Aletomerycini genera from the Tertiary, comparison of limb elements.

× †. Solid-line bracket indicates associated limbs; broken-line bracket indicates limbs of more than one individual.

FIG. 25. N.S.M.3-27-11-33, *Barbouromaryx trigonocorneus* (Barbour and Schultz), limbs of genotype, from Dawes County, Nebraska.

(See also Figs. 5, 7, 10 [dentition], 2, 14 [skull] and page 183.)

F:A.M.31360, *Parablastomeryx gregorii*, n.g. and sp., limbs of genotype, from Xmas Quarry, Cherry County, Nebraska.

(See also Fig. 22 [skull and mandible], 25B [partial manus and pes] and page 249.)

FIG. 25A. (See legend, page 265.)

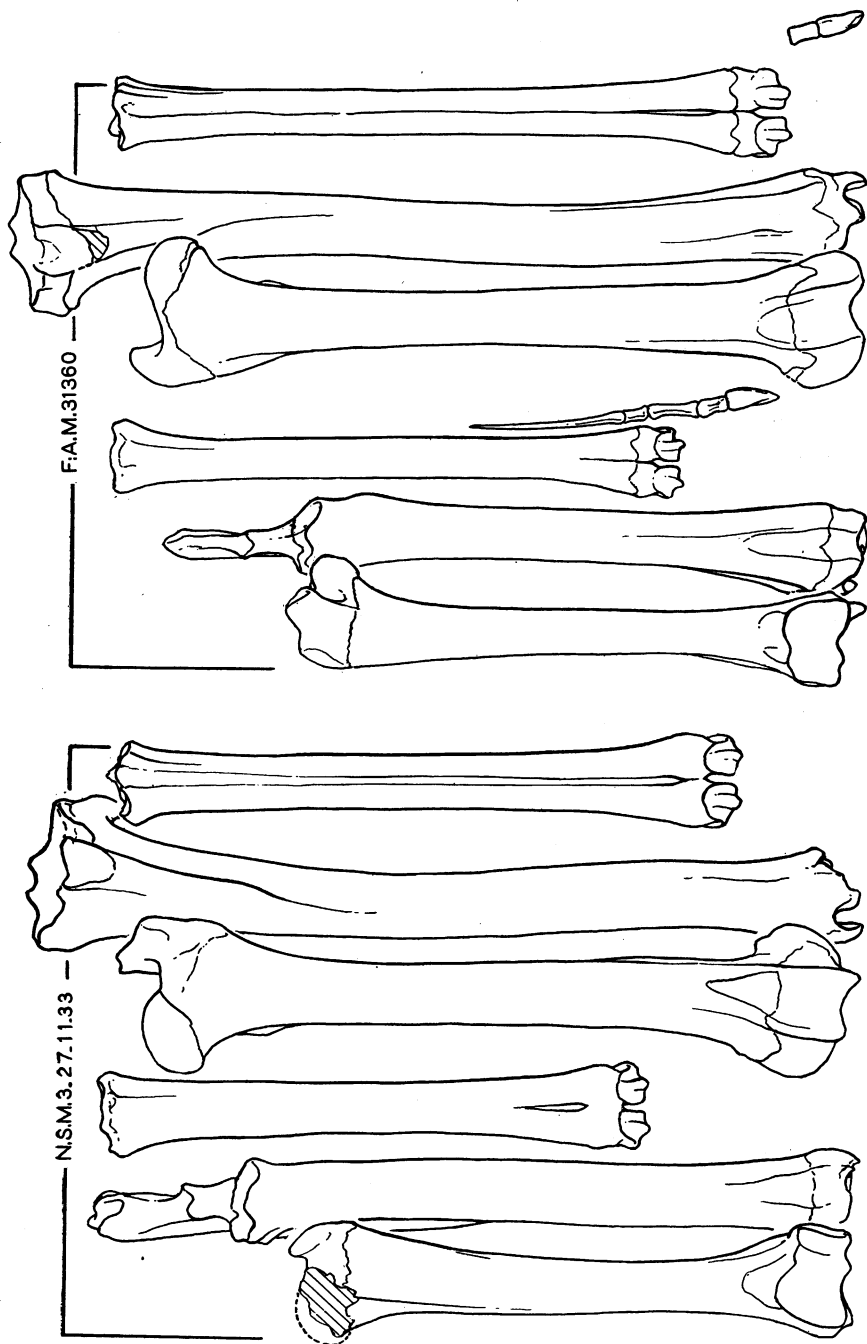


FIG. 25. *Barbouromyx*, n.g. (N.S.M.3-27-11-33), genotype, in part, and *Parablastomyx*, n.g. (F.A.M.31360), genotype, in part, from the Tertiary of Nebraska, comparison of limb elements.
 X 1. (See legend, preceding page.)

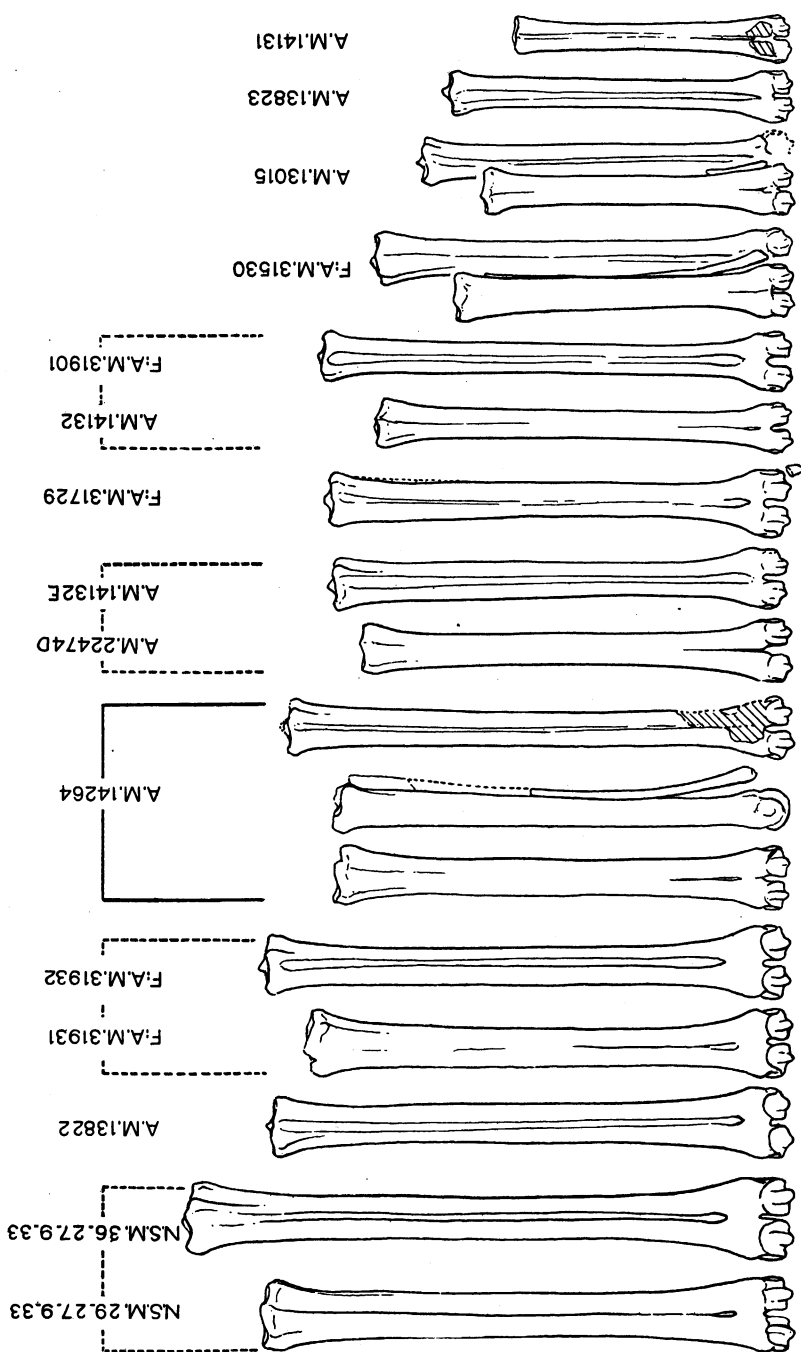


Fig. 25A. Barbouromyrcini (N.S.M. 29- and 36-27-9-33), Blastomyrcini and Aleatomyrcini (F.A.M. 31931, 31932 and A.M. 14264) genera from the Tertiary of Nebraska, South Dakota, New Mexico and Wyoming, comparison of metapodial lengths.

× 1. (See legend, page 265.)

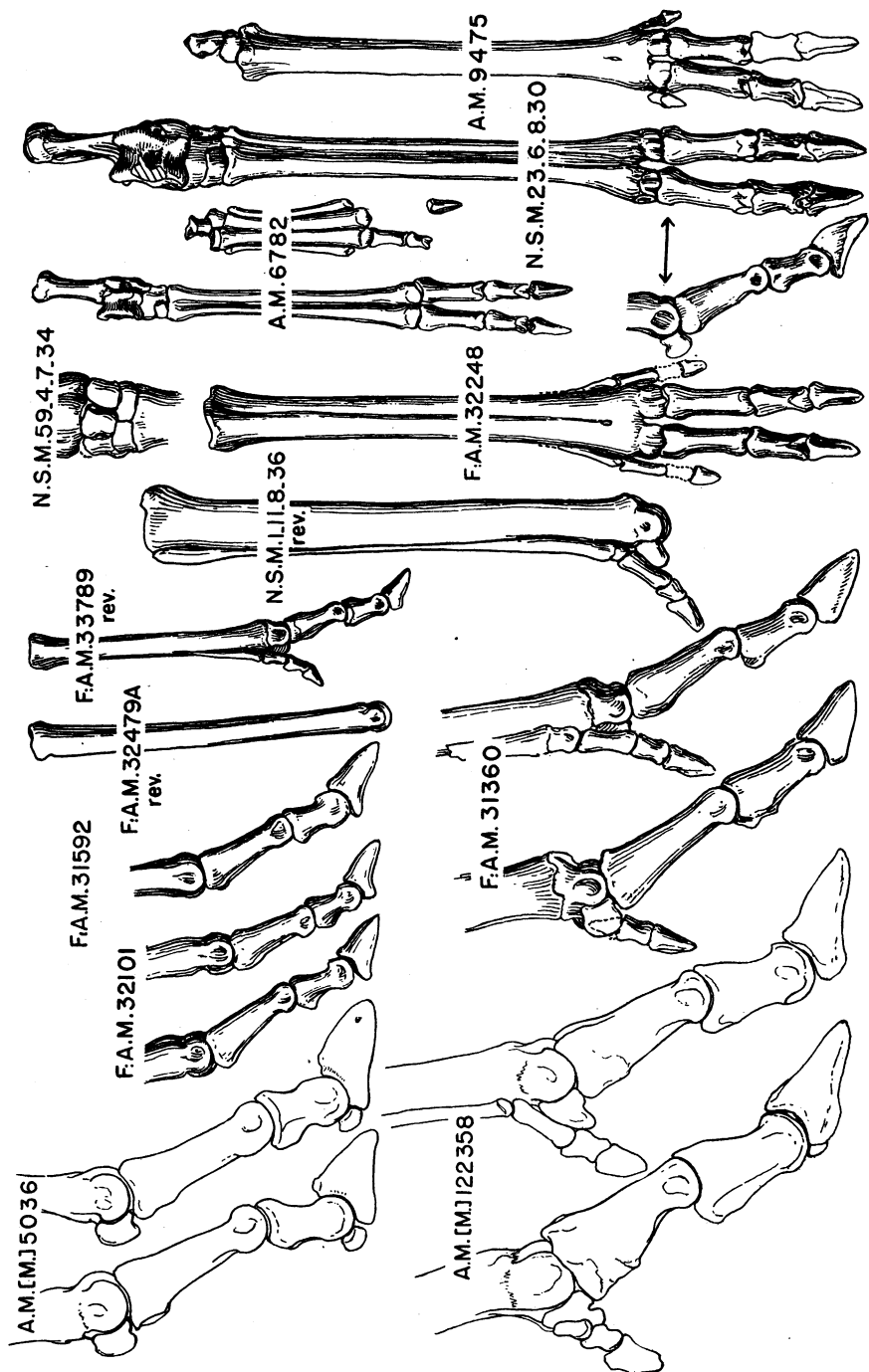


Fig. 25B. Foot elements of certain Cervidae and Antilocapridae from the Tertiary and Recent.
 X $\frac{1}{2}$. (See legend, next page.)

FIG. 25A. N.S.M.29-27-9-33 and 36-27-9-33, *Probarbouromeryx sweeti*, n.subg. and sp., ref., left metacarpus and metatarsus, from Bridgeport Quarry, Morrill County, Nebraska. (See page 184.)

A.M.13822, *Problastomeryx primus* (Matthew), subgenotype (in part), left metatarsus, from the Upper Rosebud, South Dakota. (See Fig. 24 [ramus] and page 256.)

F:A.M.31931 and 31932, *Aletomeryx gracilis* Lull, ref., right metacarpus and left metatarsus, from Antelope Creek, Cherry County, Nebraska. (See page 185.)

A.M.14264, *Aletomeryx marshi* (Lull), ref., left metacarpus (note side view showing interior lateral) and left metatarsus, from the Harrison, Nebraska. (See page 186.)

A.M.22474D and 14132E, *Blastomeryx elegans* Matthew and Cook, ref., left metacarpus and metatarsus, from Sioux County, Nebraska. (See pages 247, 248.)

F:A.M.31729, (?) *Longirostromeryx blicki*, n.sp., ref., left metatarsus, from Cuyamungue, New Mexico. (See page 247.)

A.M.14132 and F:A.M.31901, *Blastomeryx gemmifer medius* (Matthew), ref., left metacarpus and right metatarsus, from Sioux County, Nebraska. (See page 248.)

F:A.M.31530, *Pseudoblastomeryx falkenbachi*, n.subg. and sp., subgenotype (in part), right metacarpus and metatarsus, from Lusk, Wyoming. (See page 257.)

A.M.13015, *Pseudoblastomeryx advena* (Matthew), (?) ref., right metacarpus and left metatarsus, from the Rosebud, South Dakota. (See page 258.)

A.M.13823, (?) *Pseudoblastomeryx advena* (Matthew), smaller var., right metatarsus, from the Upper Rosebud, South Dakota. (See page 258.)

A.M.14131, ?*Blastomeryx* species, right metatarsus, from Sioux County, Nebraska. (See page 249.)

FIG. 25B. A.M.[M.]5036, *Antilocapra americana* Ord, ♂, partial manus and pes (Recent).

F:A.M.32101, *Plioceros dehlini*, n.sp., type (in part), ♀, partial manus and pes, from Cherry County, Nebraska. (See Fig. 26 [skull and mandible] and page 516.)

F:A.M.31592, *Ramoceros ramosus* (Cope), ref., partial manus, from New Mexico. (See Figs. 28, 28A, 29, 30 [partial cranium and horns], 48 [limbs] and page 453.)

F:A.M.32479A and 33789, *Paracosoryx wilsoni*, n.subg. and sp., ref., rev., right metacarpus and immature manus, from Sioux County, Nebraska. (See Fig. 48A [F:A.M.33789] and pages 462, 316.)

N.S.M.59-4-7-34, *Cosoryx furcatus* Leidy, ref., partial manus, from Cherry County, Nebraska. (See page 459.)

A.M.6782, *Leptomeryx evansi* or var., ref., pes and partial manus, from Logan County, Colorado. (See page 629.)

N.S.M.23-6-8-30, *Meryceros warreni johnsoni*, var., ref., pes, from Cherry County, Nebraska. (See page 466.)

A.M.9475, (?) *Cosoryx furcatus*, var. or subsp., ref., partial manus, from Colorado. (Lateral phalanges of pes, figured by Matthew, 1904, Fig. 16, supplied in error.) (See Fig. 48 [limbs] and page 461.)

A.M.[M.]122358, *Odocoileus virginianus* (Zimmermann), ♂, partial manus and pes (Recent).

F:A.M.31360, *Parablastomeryx gregorii*, n.g. and sp., genotype (in part), partial manus and pes, from Cherry County, Nebraska. (See Fig. 22 [skull and mandible], 25 [limbs] and page 249.)

N.S.M.1-11-8-36, (?) *Aletomeryx marslandensis*, var., rev., right metacarpus, from Dawes County, Nebraska. (See pages 163, 186.)

F:A.M.32248, *Aletomeryx gracilis* Lull, ref., partial manus, from Cherry County, Nebraska. (See page 185.)

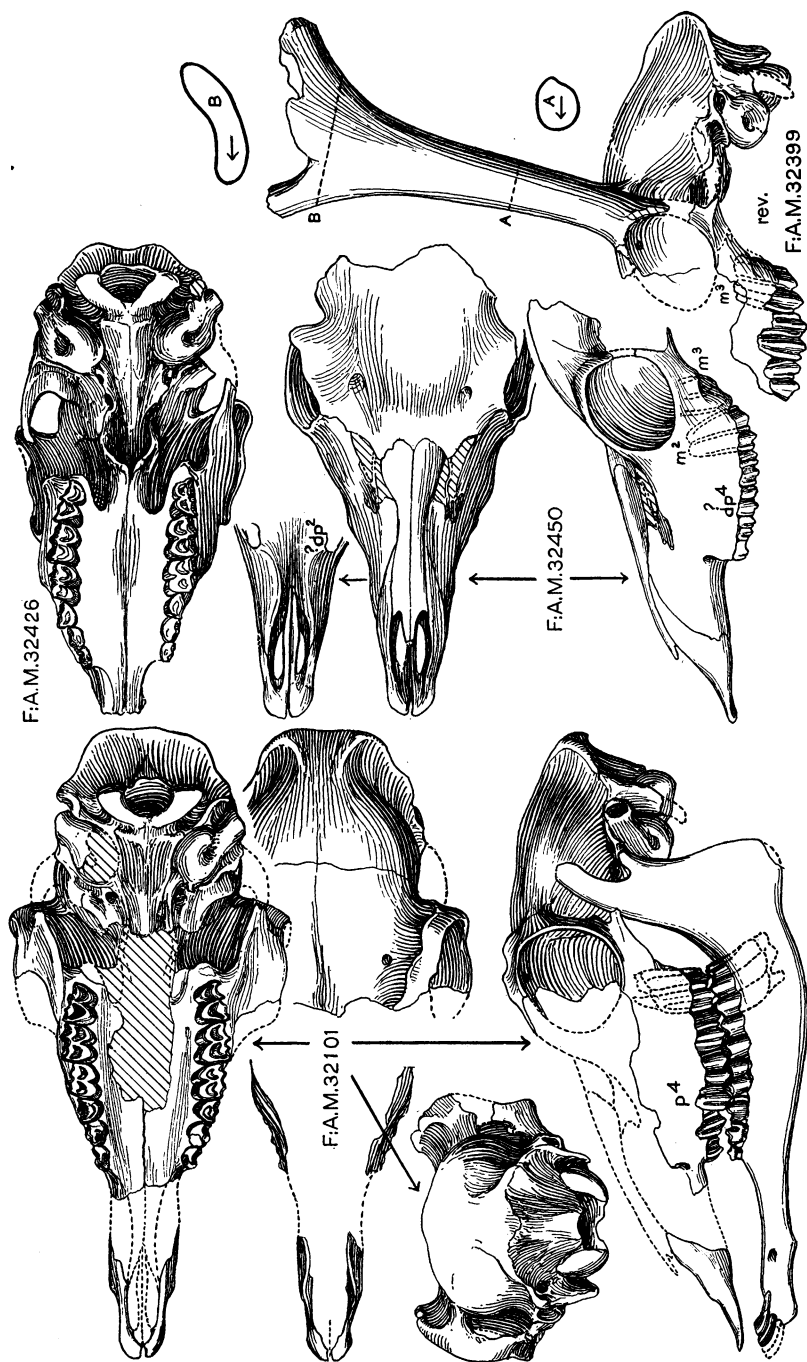


FIG. 26. *Plioceros*, n.g., ref. (F.A.M. 32101), *Cosoryx* Leidy, ref. (F.A.M. 32426 and 32450) and *Paracosoryx*, n.subg., ref. (F.A.M. 32399), comparison of Antilocaprine and Merycodontini skulls from the Late Tertiary of Nebraska.
 X ½. A, B, cross sections of horn. (See legend, next page.)

FAMILY II.—ANTILOCAPRIDÆ

See Reconstructions: Frontispiece, A & B, and Figures 27 and 49

The Antilocapridæ, in the present volume, are divided between the:

MERYCODONTINI, Late Tertiary, and
ANTILOCAPRINI, Late Tertiary and Quaternary.

Reconstructions of the heads of the more outstanding genera and subgenera are shown in the frontispiece, A and B, and Figures 27 and 49. The family is as yet unrecognized outside of America¹ and quite unknown previous to the Late Tertiary. The "horn" characters of the Merycodontini, "pronglets," and Antilocapriini, "pronghorns," have been discussed at some length in the general Introduction. The dentitions are uniformly hypsodont. The adjoining table gives the distribution of the genera and subgenera as at present recognized. The two divisions are considered in detail in the following pages, where the different genera and species appear under the numbers used in the table. Without the evidence of the horns, the Merycodontini are distinguished with difficulty from small Antilocapriini. It is quite possible that a primitive hornless Merycodontini or Antilocapriini actually may be present and unrecognized in the collections of hornless and subhypsodont-tending Blastomerycini.

Hypothetically—Forked horn-cored Antilocapriini ancestors gave rise to the unforked core and forked sheath of the modern pronghorn. The *Stockoceros* forked core was derived from the burrless *Plioceros* core and not from *Meryceros*. Differentiation in the Merycodontini was accompanied by downward retreat of the horn-core burr (and facial skin) and elongation of the sheath (*Cosoryx*), or tendency to separation of the horn-core into basal pedicle and partially deciduous antler (*Ramoceros*).

The two following tables summarize graphically the known distribution of the here recognized genera and subgenera of the divisions Antilocapriini and Merycodontini, and the number of available specimens.

¹ There is no record of the occurrence of an Antilocaprid in South America. The several doubtful references in the early literature to antelope forms were based on fragmentary remains yet to be proven non-Cervid—see *A. maquinensis* and *Leptotherium majus* and *minus* of the Brazilian Caves, Lund (1841), Branco (1883) and Ameghino (1889); and *Platatherium pampæum* Ameghino from the upper Pampean.

FIG. 26. F:A.M.32101, *Plioceros dehlini*, n.sp., type (?female), from Snake River, Cherry County, Nebraska. (See also Fig. 25B [partial manus and pes] and page 497.)

F:A.M.32426 and 32450 (immature), *Cosoryx furcatus* Leidy, ref., from Gordon Creek, Cherry County, Nebraska. (See page 341.)

F:A.M.32399, *C. (Paracosoryx) wilsoni*, possibly distinct var., rev., from Sioux County, Nebraska. (See page 352.)

TABLE VII

ANTILOCAPRID GENERA, SUBGENERA AND SPECIES OF THE AMERICAN LATE TERTIARY—OCCURRENCE AND TOTALS OF AVAILABLE SPECIMENS (Roman and arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in () from type, and in [] from other than type area for the particular species.) (See Introduction, page 7.)

	Genus Number	Uppermost														Specimen Count							
		Eden, Calif.	Rattlesnake (and *Malheur Co.), Oreg.	Thousand Creek, Nev.	Hemphill Co., Tex. (and *Guymon, Okla.)	Yuma Co., (and *N.E.) Colo.	Kat Qu. (or *possible equiv. Brown and Cherry Cos.), Nebr.	Benson, Ariz.	N. Rio Grande (*Round Mt. and tpossible equiv.), N. Mex.	U. Snake Creek, Sioux Co., Nebr.	Republican River, Nebr. (and *Kansas)	Ricardo (and *Teton Hills) Calif.	Barstow, Calif. (and *Skull Spring, Oreg.)	Virgin Valley (*High Rock Canyon and tTonopah), Nev.	Santa Fé, N. Mex.		Pawnee Creek (and *Sterling), Colo.	Burge (and *Midway), Nebr.	*Crookston (or equiv.), Nebr.	Sioux Co. (*Dawes Co. and tGarman L. F., in pt.), Nebr.	L. White River (and *Bijou Hills), S. Dak.	S. of Logan (*Madison Valley and tGardiner), Mont.	
B.—ANTILOCAPRINI																							
<i>Osbornoceros</i> , n.g.	IV			(1)																			
<i>Illingoceros</i> Merriam	V			(1a)																			
<i>Sphenophalos</i> Merriam	VA		(1a)	(1)																			
<i>Plioceros</i> , n.g.	VI		* (3)	(4)			* (2) * (2a) [2a]		† (1)														
<i>Tetoceros</i> , n.g.	VII	? (5)			*? (1b) * (1) (1a)	↑ ? (2) *? [2]		? (3)		? (4)													
<i>Proantilocapra</i> Barbour and Schultz	VIII						* (1)																
Total Antilocapriini																							340

A.—MERYCODYNTINI

<i>Ramoceros</i> , n.g.	I									(1) (2)	(3)	[4]					70
<i>Paramoceros</i> , n. subg.	IA									(5) (8)		(6)					25
<i>Merriamoceros</i> , n. subg.	IB																136
<i>Cosoryx</i> Leidy	II									(2)	* (7) [7]	(3) † [3]	(3) † [3]	(5) * (5a)	(6) * ? (6a) † ? (6b)		551
" <i>Merycodus</i> " Leidy																	1
<i>Subcosoryx</i> , n.subg.	IIA																1090
<i>Paracosoryx</i> , n. subg., and <i>Subparacosoryx</i> , n.subg. [sp.(14)]	IIB IIC									† (11) * (11a) [11b]			(13) (14) (14a) * (15)				734
<i>Meryceros</i> , n.g.	III									(6) † (7)	(1) (2)	(5) [4a]	(3) (4) * (4a)				708
<i>Submeryceros</i> , n. subg.	IIIA									(8) ? (9) ? (10)	(8) ? (9b)						19

*†, refer to localities as shown in column headings.
†, questions the generic or subgeneric reference.

Merycodontini specimens unallocated to species, not included in table	825
Total Merycodontini	4219
Late Tertiary Antilocapri	340
Quaternary Antilocapri (page 476)	83
Antilocapri and Merycodontini, Grand Total Available Specimens	4642

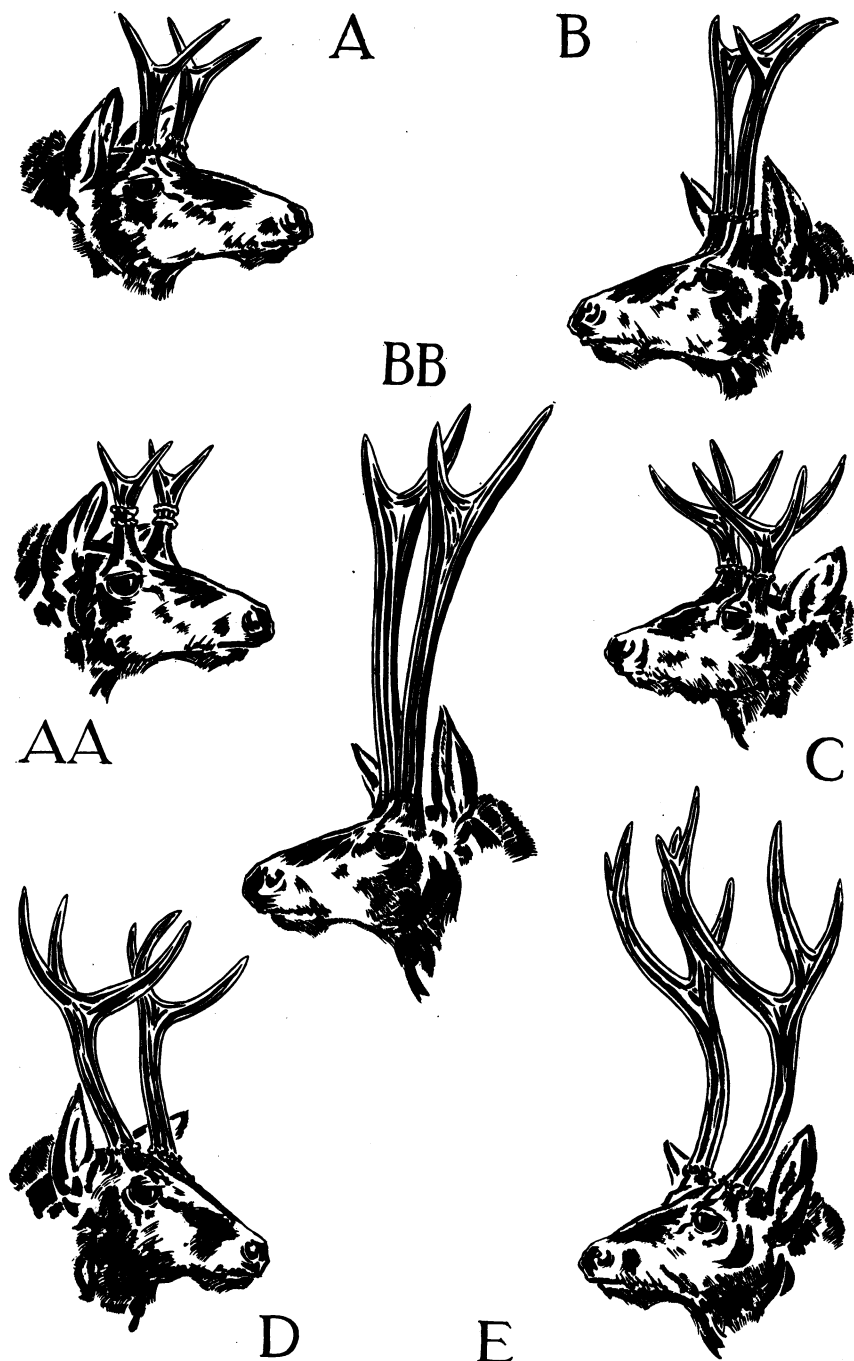


FIG. 27. Pronglets, Merycodontini, of the American Late Tertiary.

Reconstructions $\times$ approximately $\frac{1}{2}$. (See legend, page 277.)

Meryceros, n.g. (A)

Paracosoryx, n.subg. (B)

Subparacosoryx, n.subg. (AA)

Paramoceros, n.subg. (C)

Paracosoryx, ref. species (BB)

Paramoceros, ref. species (D)

Ramoceros, n.g. (E)

See *Merriamoceros* reconstruction, Frontispiece, A

DIVISION A.—MERYCODONTINI

Subfamily 1.—*Ramocerotinæ*

I. *RAMOCEROS*, NEW GENUS

IA. *PARAMOCEROS*, NEW SUBGENUS

IB. *MERRIAMOCEROS*, NEW SUBGENUS

Subfamily 2.—*Cosorycinaë*

II. *COSORYX* LEIDY

IIA. *SUBCOSORYX*, NEW SUBGENUS

IIB. *PARACOSORYX*, NEW SUBGENUS

IIC. *SUBPARACOSORYX*, NEW SUBGENUS

III. *MERYCEROS*, NEW GENUS

IIIA. *SUBMERYCEROS*, NEW SUBGENUS

Frontispiece, A, and Figure 27 (Reconstructions); Figures 28–40 and (in part) 2, 2A, 26 (Skulls and Horns); 41–47A and (in part) 28B, 35A, 37, 37A, 38 (Mandibular Dentitions); (in part) 26, 28A–C, 37, 37A, 40 (Maxillary Dentitions); (in part) 25B, 38, 48 (Limbs)

SECTIONS: I, DISCUSSION; II, "HORNS"; III, DENTITIONS AND MANDIBULAR RAMI; IV, LIMBS

SECTION I.—DISCUSSION

The diminutive Antilocaprid pronglets, or Merycodontini, the Merycodonts of the literature, had a wide range in the Late Tertiary of North America. They are characterized by tall-crowned teeth, slender elongate limbs and especially by the pseudo-Cervine-formed "horns" of the males. While the latter differ in shape and in position, at times being antler-like and highly suggestive of the deer, the uniformly tall-crowned dentitions are at once distinguishable from the contemporary Cervids of similar size (*Blastomerycini*) in which the teeth are brachyodont and the superior canines much enlarged. Heads of the more characteristic of the so far recognized forms are shown in hypothetical reconstruction as in life on the opposite page (Fig. 27) and the frontispiece, A. Unrecognized in the uppermost and but doubtfully present in the lowermost

(Continued on page 276)

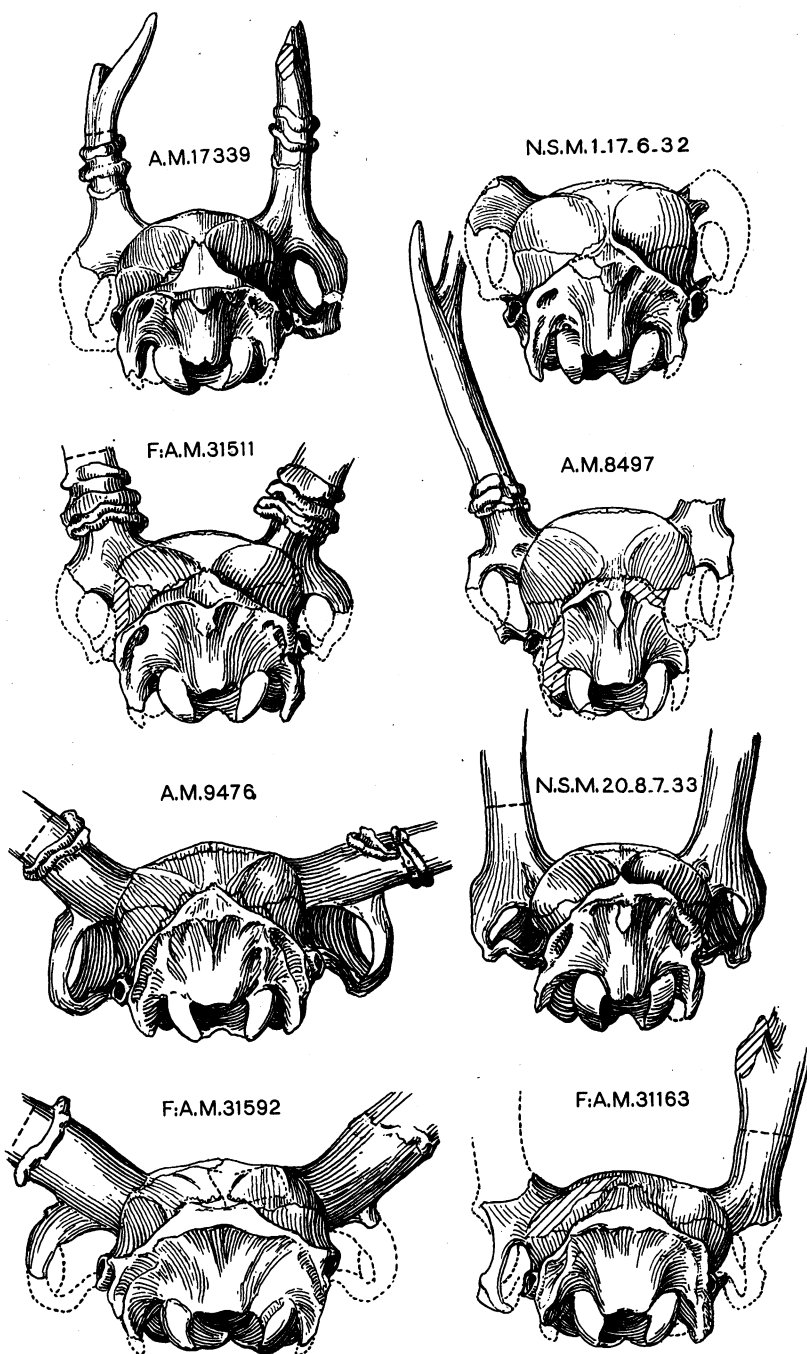


FIG. 28. Merycodontini genera and subgenera, *Subparacosoryx*, n.subg. (A.M. 17339, subgenotype), *Meryceros*, n.g. (N.S.M.1-17-6-32, 20-8-7-33 and F.A.M. 31163), *Cosoryx* Leidy (F.A.M.31511 and A.M.8497) and *Ramoceros*, n.g. (A.M. 9476 and F.A.M.31592), comparison of skulls from the American Late Tertiary.

Occipital views $\times \frac{1}{2}$. (See legend, page 277.)

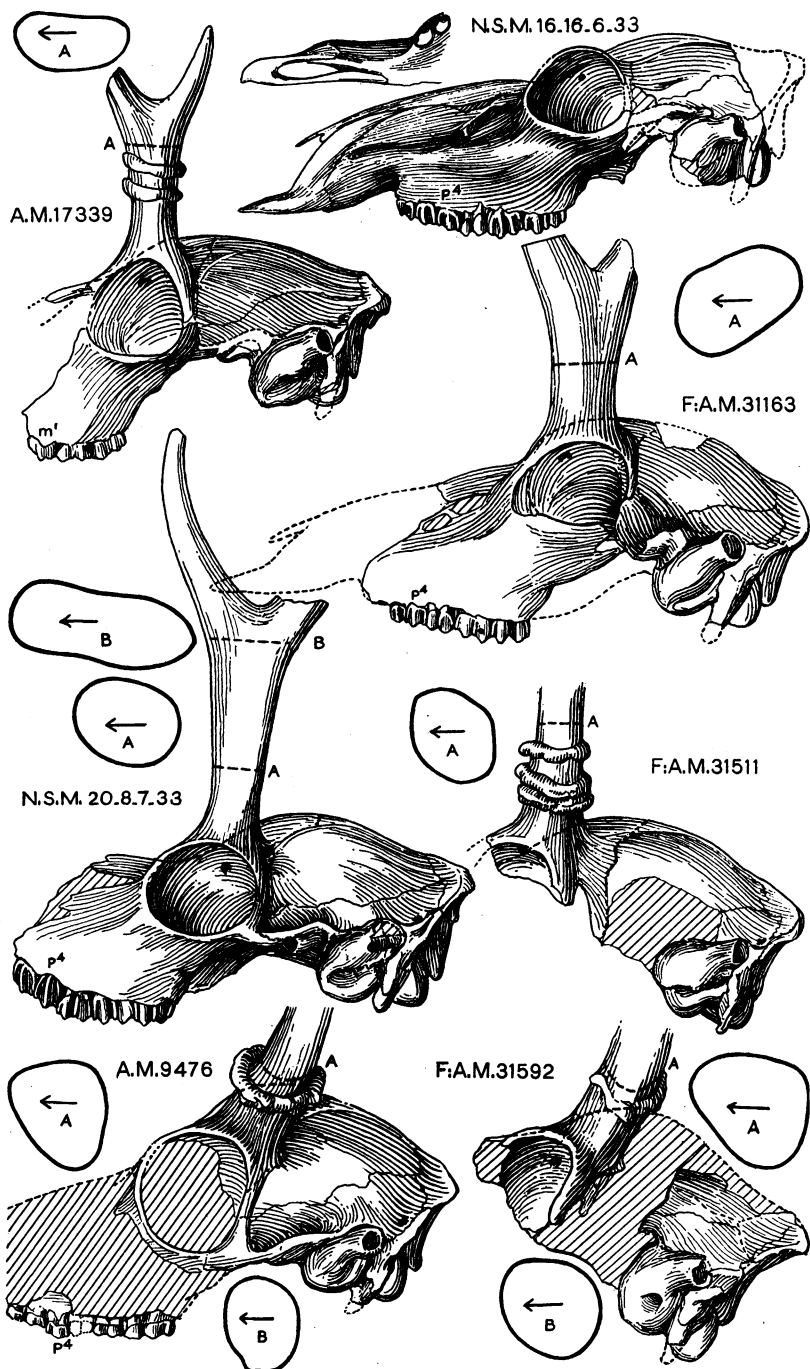


FIG. 28A. Merycodontini genera and subgenera, *Subparacosoryx*, n.subg. (A.M. 17339, subgenotype), *Meryceros*, n.g. (N.S.M.16-16-6-33, F.A.M.31163 and N.S.M.20-8-7-33), *Cosoryx* Leidy (F.A.M.31511) and *Ramoceros*, n.g. (A.M.9476 and F.A.M.31592), comparison of skulls from the American Late Tertiary.

Lateral views $\times \frac{1}{2}$. (See legend, page 277.)

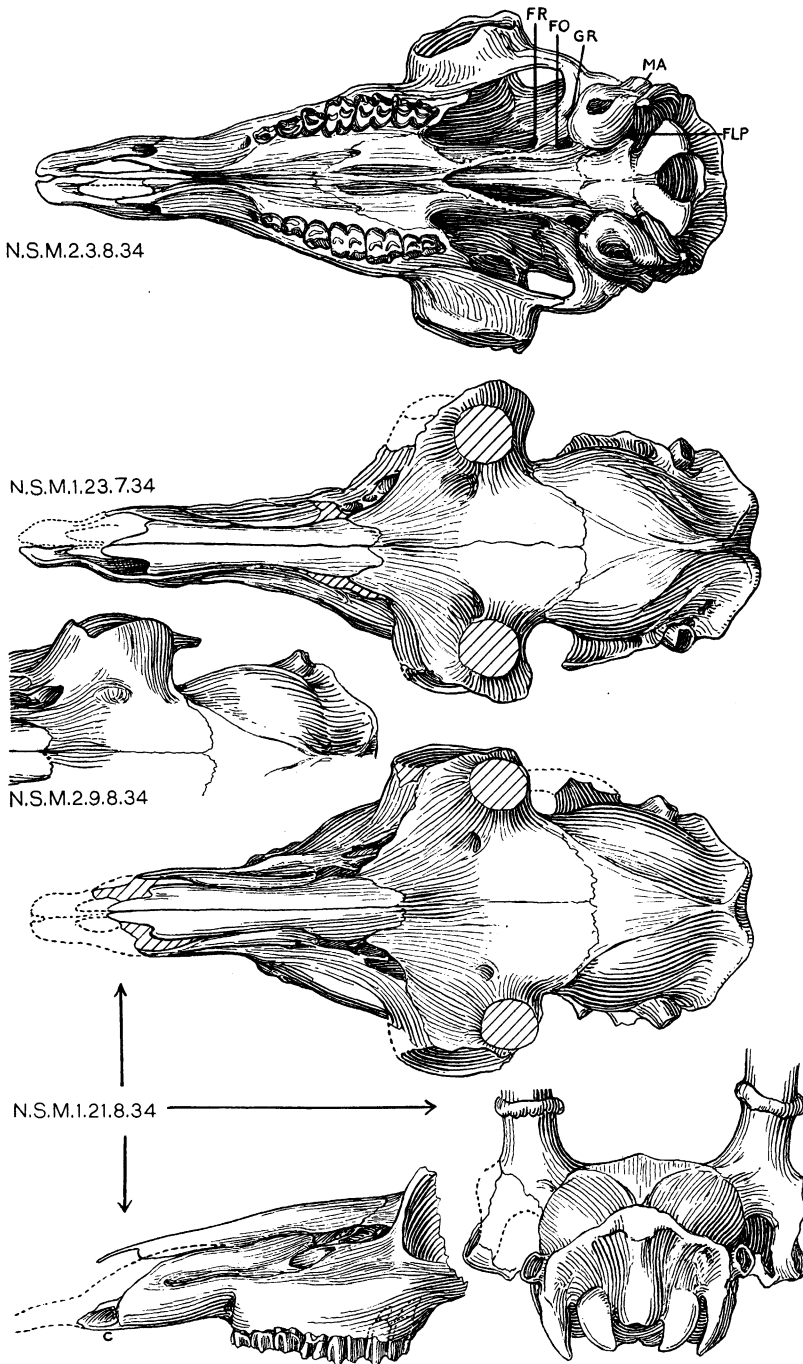


FIG. 28C. *Meryceros warreni johnsoni*, n.subsp., sexual and individual variation in three mature males (N.S.M.2-3-8-34, type, 1-23-7-34 and 1-21-8-34), and mature female (2-9-8-34), from Crookston Bridge, Cherry County, Nebraska. $\times \frac{1}{2}$. FLP, foramen lacerum posterius; FO, foramen ovale; FR, foramen rotundum; GR, glenoid foramen; MA, auditory meatus. In palatal view of N.S.M.2-3-8-34, the vomer and adjacent area have been supplied from 1-21-8-34, and the palatal suture from 2-9-8-34. (See also Figs. 2 [N.S.M.1-23-7-34], 2A [N.S.M.1-21-8-34], 28B [N.S.M.2-3-8-34, 1-23-7-34 and 2-9-8-34] and pages 363, 364.)

levels, Merycodont remains are of frequent occurrence in the formations of the main portion of the Late Tertiary where the pronglets are the best represented of the horned groups. Their plentifulness,¹ great diversification and considerable vertical range might make these fascinating remains easily read records of variation and development, were it not for the scarcity of definitely associated material. With the vast collections that the future may produce, the Merycodonts well may prove to be one of the best keys to Late Tertiary correlation. The manner of the growth and the question of replacement of the "horns" have long been in doubt. The genotypic species, *Merycodus necatus* Leidy (1854), was based on fragmental and indefinitely characterized teeth from the Bijou Hills and remains indeterminate.

Since the original completion of the present preliminary studies and attempted subdivision of the Merycodontini, mainly on the characters of the horns (because of dearth of associated dentitions), certain collections have been secured, from restricted and well-defined horizons of widely remote localities in New Mexico, north and southwest Nebraska and California, of definitely associated horns, crania and mandibles. Interestingly enough, such recent finds include series of horns, which in a number of instances differ from those of other localities, and mandibular rami of equally well-defined character. These additional collections have permitted some adjustment of our original treatment of the group. As might be expected, Merycodontini horns and teeth tend to vary independently; the mandible and dentition evidently were more conservative than the horns.

The Merycodontini, on the previously known and the more recently available and far more ample data as to the characters of the horns and (to less degree) dentitions, are divided between three main—*Ramoceros*, n.g., *Cosoryx* Leidy and *Meryceros*, n.g.—and several minor groups. As more fully discussed below, it is impossible as yet to determine which of these groups is represented by the lost type of *Merycodus* Leidy or, in many cases, definitely to allocate detached ramal dentitions and limbs from localities in New Mexico, Nebraska and California. Because of the advantage for ready intercomparison of like parts with like, and on account of the scarcity, until recently, of definitely associated remains, consideration of the Merycodontini in these pages has been divided between the introductory Discussion (Part I), and three separate but cross-referenced sections, "Horns" (Part II), Dentitions (Part III) and Limbs (Part IV).

¹ Total specimens, 4219.

Fig. 27. Reconstructions based on:

- (A) *Meryceros warreni johnsoni*, n.subsp., Crookston Bridge Quarry, Cherry County, Nebraska
- (AA) *Subparacosoryx savaronis*, n.subg. and sp., Sioux County, Nebraska
- (B) *Paracosoryx wilsoni*, n.subg. and sp., Sioux County, Nebraska
- (BB) *Paracosoryx alticornis*, n.sp., Barstow, California
- (C) *Paramoceros brevicornis*, n.subg. and sp., Barstow, California
- (D) *Paramoceros marthae*, n.sp., Santa Fé County, New Mexico
- (E) *Ramoceros ramosus* (Cope), Santa Fé County, New Mexico

FIGS. 28 AND 28A. Merycodontini genera and subgenera, comparison of skulls from the American Late Tertiary.

Occipital and lateral views $\times \frac{1}{2}$. A, B, cross sections of horns.

FIG. 28. A.M.17339, *C. (Subparacosoryx) savaronis*, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(See also Fig. 28A and page 353.)

N.S.M.1-17-6-32, *Meryceros warreni johnsoni*, n.subsp., ref. ♀, from Crookston Bridge, Cherry County, Nebraska.

(See page 364.)

F.A.M.31511, *Cosoryx furcatus sternbergi*, n.subsp., type (in part), from Kansas.

(See also Figs. 28A, 36, 36A; ramus, Fig. 43; and page 344.)

A.M.8497, *Cosoryx furcatus* Leidy, ref., from Driftwood Creek, Hitchcock County, Nebraska.

(See also Fig. 36 and page 344.)

A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), from Pawnee Creek, Colorado.

(See also Fig. 28A; ramus, Fig. 43; and page 328.)

N.S.M.20-8-7-33, *Meryceros warreni johnsoni*, var., ref., from Valentine, Cherry County, Nebraska.

(See also Fig. 28A and page 366.)

F.A.M.31592, *Ramoceros ramosus* (Cope), ref., from Lower Pojuaque Bluffs, New Mexico.

(See also Figs. 28A [lateral view of cranium], 29, 30 [horns], 25B [partial manus], 48 [limbs], and page 324.)

F.A.M.31163, *Meryceros joraki*, n.sp., type, from Barstow, California.

(See also Fig. 28A and page 368.)

FIG. 28A. A.M.17339, *C. (Subparacosoryx) savaronis*, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(See also Fig. 28 and page 353.)

N.S.M.16-16-6-33, *Meryceros warreni johnsoni*, var., ref. ♀, from Valentine, Cherry County, Nebraska.

(See page 366.)

F.A.M.31163, *Meryceros joraki*, n.sp., type, from Barstow, California. (Horn and restoration from opposite side.)

(See also Fig. 28 and page 368.)

N.S.M.20-8-7-33, *Meryceros warreni johnsoni*, var., ref., from Valentine, Cherry County, Nebraska.

(See also Fig. 28 and page 366.)

F.A.M.31511, *Cosoryx furcatus sternbergi*, n.subsp., type (in part), from Kansas.

(See also Figs. 28, 36, 36A; ramus, Fig. 43; and page 344.)

A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), from Pawnee Creek, Colorado.

(See also Fig. 28; ramus, Fig. 43; and page 328.)

F.A.M.31592, *Ramoceros ramosus* (Cope), ref., from Lower Pojuaque Bluffs, New Mexico.

(See also Figs. 28 [posterior view of cranium], 29, 30 [horns], 25B [partial manus], 48 [limbs], and page 324.)

Characters of the Merycodontini

The dentition is strongly hypsodont; the $I_s/$ and p_1^1 are lost; un-enlarged $Cs/$ are retained, at least occasionally, in both sexes (Fig. 28B); and the $/Cs$ are incisive-formed. The lengths of the paired frontal appendages of the mature males vary from 50 to 100% of the skull lengths and are of several distinct forms, viz.: (*Ramoceros*) three- to four-pointed postorbital "antlers," (*Cosoryx*) moderate to tall supra-orbital shafts with short-tending forked prongs, and (*Meryceros*) shorter and more laterally compressed shafts with variable forks. The basal burrs are single or multiple, lightly attached or frequently absent. The frontal area of the skull anteromedian to the horn-cores is strongly depressed; the nasals and muzzle may be extremely long and slender; the premaxillæ widely separate the anterior nasals and maxillæ; the tubular orbits are strongly produced laterally; the postorbital ridges are united in a low sagittal crest (the parietal area being relatively short in *Ramoceros* and longer in *Meryceros*); the inion is broad, indented and over-reaches the condyles; the posterior palate is produced and tubular; the auditory bullæ are full (possibly less so in *Ramoceros*) and the auditory meatus long and erect (possibly more so in *Cosoryx*); unossified pre-orbital vacuities and both infra- and supra-orbital foramina are present; the limbs are of slender Antilocaprine proportions, the metacarpal length apparently somewhat approximating the incisive border to foramen magnum distance. Remnants of the laterals and their phalanges were retained occasionally, at least, in the manus (Fig. 25B).

The skull is definitely pronghorn-like versus deer-like, the orbits being prominent and tubular, the nasals and muzzle long and slender, the pre-maxilla-nasal contact wide, the muzzle and incisive border unconstricted distally, the lacrimal glandular depression of the deer absent, the horns postero-supra-orbital (versus frequently more posterior to the orbit) and the frontoparietal suture straight (versus inverted U-shaped in the deer). While the enlargement of the occipital area and tubular condition of the posterior palate are perhaps suggestive of the deer rather than the pronghorn, the condition of the posterior cranium must have been primarily dependent on horn form. The arrangement of the postglenoid, of the hyoid troughs of the bullæ, etc., tend to be Antilocaprine.

Examples of the crania of *Ramoceros*, *Cosoryx* and *Meryceros* are figured on two adjacent pages in lateral and occipital views, Figs. 28 and 28A, and examples of the Crookston and Nenzel *Meryceros* in three Figs. 28B, C and 40. The drawings portray the depression of the relatively

low posterior occipital area, the moderate development of the sagittal crest, the indentation of the relatively wide inion, the fullness and position of the bullæ and the arrangement of the mastoid area, etc. They further indicate the more posterior and depressed position of the horns, the relatively short posterior cranium and more circular horn section of *Ramoceros* versus *Cosoryx* and *Meryceros*. The writer has yet to view a complete or nearly complete skull of *Ramoceros*. As seen in *Meryceros* and *Cosoryx* the premaxillæ and nasals are extremely elongate and slender and the occipital area low and unproduced. The figures portray the slenderness of the muzzle, the prominence of the orbits and the elevation of the midfrontal area of the cranium. Additional crania are illustrated on Figures 2, 26, 37 and 37A (in part).

Ramoceros, n.g., and *Meryceros*, n.g., are well represented by the fine series of detached horns and dentitions, etc., in the collections amassed by the late Joseph Rak from the Santa Fé area, New Mexico. The former genus is almost unknown elsewhere. *Cosoryx* Leidy is seen in rare examples from several scattered areas and in the very useful series secured by M. F. Skinner from a northern Nebraska locality. *Subcosoryx*, n.subg., with uniquely reduced premolars, is limited so far to the single New Mexican horizon. *Paracosoryx*, n.subg., with peculiarly abbreviated diastema, is recognized in remains collected by Jack Wilson from localities in western Nebraska and the Mojave, California. *Meryceros*, represented in our collections by many detached specimens from various areas, is best observed in the exquisite series collected by F. W. Johnson and party at Crookston in northern Nebraska and placed at the writer's service through the kindness of Professor E. H. Barbour of the Nebraska State University. This superb series of skulls, associated and non-associated rami and limbs, and a fine *Meryceros* series secured by M. F. Skinner from Nenzel, indicate the considerable variation in size and other characters occurring within two species of the genus. Additional specimens, discovered some months after the completion of our original studies, have permitted a rechecking of the Merycodontine evidence as a whole and a more satisfactory allocation of detached mandibular and maxillary dentitions to the species represented by horns. Far more time than has been given to the Merycodontini well might be spent in further and more careful study of the now available collections. The present and preliminary revision at best must be considered no more than a step toward a clearer understanding of this diversified and formerly widely distributed group.

The Problem of the "Horns"

The actual method of growth and nature of the covering of the Merycodontini "horn" remains a conundrum, though the available evidence as here interpreted points to the probability of there having been, in such forms at least as *Ramoceros*, a from time to time replacement somewhat after the method in the Recent deer. The small to large examples suggestive of growth stages in the extensive New Mexican series of horns of the several *Ramoceros* shapes, plus our inability to understand how such hardened structures went through the necessary changes attendant on increase of size except by some process of periodic shedding and replacement as in the deer, seem to indicate their necessarily deciduous character. Variable-sized examples of several such horn series are figured. The Nenzel and Crookston *Meryceros* collections include four crania with dp^2 - dp^4 (worn) and nub-like horn-cores, the specimens being interpreted as of immature moles in rudimentary "spike-horn" stage (F:A.M. 32175 [Fig. 40] and N.S.M. 4- and 9-7-9-34, and 1-19-9-34 [Fig. 28B]). The nubs in specimens N.S.M. 9-7-9-34 and 1-19-9-34 indicate the former presence of distal extremities now broken off or shed. Again a lone fragment of *Ramoceros*, from Fairfield Creek, Nebraska, shows a mature horn-pedicle with burr, above which the horn has been broken off—by accident or natural shedding. The "core" in *Meryceros* is placed more anteriorly than in the case of the pedicle in *Aletomeryx gracilis*. A specimen of *Paracosoryx wilsoni* (F:A.M. 32895, Fig. 37) is especially interesting in the aborted character of the shaft of one side which, exhibiting a second burr some distance above the first, suggests that the horn is in process of repair. The anterior prong of the opposite "undamaged" shaft in this specimen is extremely rudimentary, the fork sharply contrasting with the extremely palmate fork of specimen F:A.M. 32399 (Fig. 26). While a very rudimentary unforked stage is recognized in the case of the immature horn of *Meryceros*, neither the unforked nor forked stages are as yet recognized in the three- to four-pronged *Ramoceros*.

It is necessary (as observed above) to look upon the Merycodontini as of the Antilocapridæ, notwithstanding the apparent general similarity of the Merycodontine horn to the Cervine antler rather than to the Antilocaprine horn-core. The absence of shed horns with burrs attached might be due to several causes. In the first place, accumulations of the preserved remains were probably largely seasonal and ever dependent on a supply of feed and water for the animals in or about

areas where sediments were accumulating. Examples of the "winter" hornless state might be missing from sedimentary deposits through the herds dwelling at that season in highlands undergoing erosion rather than in such basins of sedimentary accumulation. The cross sections of horns taken both above and below the origin of the burr always seem to exhibit a similar structure of variably porous central core with intermediate middle and dense outer areas. It seems natural that the lightly attached burr should frequently be lost through breaking off of the same through wear in life (see muntjac) or subsequent chance. The burr may be lightly attached in the Recent deer in the early velvet stage. Multiple burrs might be accounted for through periodical retreat of the velvet and encroachment of the head covering. As the Merycodontini are not Cervids, but are Antilocaprids with an horn adaptation outwardly simulating that of the Cervids, the presence of shed horns with Cervid-like burr attached, in final analysis, is not necessarily to be expected.

Since this manuscript was originally prepared for the press, interesting light has been thrown on the question of the Merycodontine "horn", through the superb series of male crania of *Meryceros* secured from Crookston Bridge by F. W. Johnson and party of the University of Nebraska. The horns themselves tend to exhibit the two major shapes observed in remains from New Mexico and Nenzel, Nebraska, a taller, more slender and less flared, and a shorter, heavier and more branching horn. Interestingly enough a comparison of the tooth wear and horn form in the Crookston Bridge series indicates that the more slender-shaped and burrless horns belong to the less aged individuals. It may be that the tall burrless shaft with moderate-length forks was typical of early maturity, and the shorter burred shaft with longer fork was developed with more advanced age. The anterior prongs of one Crookston specimen are very definitely worn, the wear being prominent on both prongs, and evidently having taken place in life and when that portion, at least, of the horns was unprotected by covering. A similar condition would be impossible in the case of *Antilocapra* where, although the sheath is deciduous, the core is never uncovered. In the particular specimen the anterior prongs are relatively short—the anterior fork normally in the Crookston series being longer than the posterior. The occurrence in both the Crookston and Nenzel series of immature specimens in which m^3 has not erupted and the horns are represented by rudimentary nub-like processes, and in the case of two such specimens the apparent evidence as to the former presence of a "shed" capping, has been noted. In the Recent pronghorn calf, with m^2 unerupted, the future

cores are but "pin-points"; with p^4 and m^3 about to erupt they become sizable nubs. The burr of a lately secured *Paracosoryx wilsoni* horn-core lies just below the fork and indicates a height of facial skin proportionate to that of *Cervulus*.

The specimens then available seem to have suggested to E. D. Cope that the Merycodontine horns were in the process of becoming deciduous. Cope (1874, p. 16) concludes "that the genus *Cosoryx* represents the ancestral type of the Cervidæ, and explains the origin of the remarkable type of horns of that family...; the separation of the dead from the living bone by suppuration..." (1877, p. 348) "...It is very probable that a genus allied to the present one gave origin to the family of the Deer. It is obvious that the horns of *Dicrocerus* did not possess a horny sheath as in the *Bovidæ*, from the fact of their being branched. As the sheath grows by addition at the base, the presence of branches, which necessarily obstruct its forward movement, would be fatal to the process. There is much to be said in favor of the view that the horns were covered with an integument, probably furred, as in the Giraffe and young of the Deer. Thus there are grooves on the beam for superficial blood-vessels, which must have been protected by skin. [p. 349]...It is not probable that this genus is the immediate ancestor of *Cervus*, from the fact that the molar teeth display in their prismatic form a higher degree of specialization than belongs to that genus. It is probable that the true ancestor combined the dental type of *Cervus*, with the distinct roots and short crowns of the molars, with the type of horns here described..." Cope (1877, p. 347) follows Gervais in assigning *Cosoryx* Leidy (and *Merycodus* Leidy) to *Dicrocerus* Gervais. *Dicrocerus*, genotypic species *D. elegans*, and referred species of the European Miocene, are generally conceded to be of the Cervidæ. While certain of the "horns" from Sansan as figured by Filhol (1891, Pls. xxxv, Figs. 4, 6; xxxvi, Figs. 6, 4; and xxxvii, Figs. 10-12) recall certain of the here-figured Merycodontini, it is yet to be proven that the former represent more than specializations of the Cervid horn-pedicle.

W. B. Scott (1890, p. 84) observes that the condition of the burr of *Cosoryx* "can hardly be regarded as ... evidence that the antler was deciduous."

W. D. Matthew (1904, p. 105) once considered the horns to have been deciduous, observing "...Antlers supra-orbital, deciduous, branched, three-tined in mature, two-tined in younger adult, probably single-tined or absent in earlier stages ... brow tine absent..." (1918, p. 220, under Fig. 18) "...Two complete burrs and traces of a third are pre-

served, indicating repeated shedding of the antlers, probably annual." Matthew (1924, pp. 202-206), in the course of a detailed reconsideration of the evidence, observes "...Antlers on both male and female... Antlers are not more than once forked, except in one species or group of species... The forking is not a progressive character... The 'antlers' are unlike those of the Cervidæ in their smooth hard surface... The burr ... may be single, double or triple ... is very easily broken off and leaves no perceptible scar ... NEVER FOUND BROKEN OFF AT THE BURR... Obviously a multiple burr could not normally occur with a deciduous antler. But in *Merycodus* the multiple burr is certainly a normal character. It appears to me far more reasonable, therefore, to conclude that the bony horn-cores were not deciduous... If, as now appears, the 'antlers' were NOT deciduous but their sheath periodically renewed as in *Antilocapra*, it does not appear that there is any evidence left for cervid affinities. All the characters conform in indicating antilocaprid relationship."

E. L. Furlong (1932, pp. 152-154) agrees with Cope that the *Merycodus* antlers were of a different character from the deciduous antlers of the deer. "No specimens or records examined show the horn shed from above or at the burr... If these animals annually shed their horns it appears reasonable to suppose that, among so many specimens occurring in the fossil record, some would show the separation of the beam carrying the tines at the point of normal separation in the region of the burr, as in the deer... The burrs are not ankylosed to the beam nor does this tissue form any part of the beam as in *Odocoileus*... A transverse section through the burr and underlying beam shows a distinct line of demarcation between the two... The burrs, then, may be regarded as the terminal point of the heavier skin covering of the head, and the initial point of growth of the lighter covering of the antlers..."

AVAILABLE CRANIA

While the characters of the skull of *Meryceros* and *Cosoryx* now are observable in well-preserved specimens, many of the cranial details in *Ramoceros* are still unknown. Outstanding among the available *Meryceros* remains is the series of some twenty-six mature skulls in the University of Nebraska collection from Crookston, Cherry County. Five of these specimens show the premaxillæ, preserved also in two specimens from Valentine A and Burge Quarries. (Crookston, Figs. 28B and 28C; Valentine, Fig. 28A; and Burge, Fig. 37A.) The characters of the *Co-*

soryx crania are nicely shown by two Gordon Creek specimens—an immature skull (F:A.M.32450, Fig. 26) in which the premaxillæ are preserved, and a female specimen (F:A.M.32426, Fig. 26) which is unique in the Merycodontine series in the retention of the pterygoids and beautiful preservation of that area. The most useful Merycodontine cranial specimens known to the writer are:

Ramoceros ramosus (Cope), referred, from New Mexico

F:A.M.31592, posterior cranium with horns and ?associated maxilla (w) and limbs. Figs. 28, 28A, 29, 30, 43. $m^3 = ((13.5))$ mm.

R. osborni (Matthew), from Colorado

A.M.9476, posterior one-third cranium with horns associated with p^2-m^3 (w++), ramus and limbs. Figs. 28, 28A, 43. m^3 base = 12.8 mm.

R. (Paramoceros) howardæ, n.sp., from Brown County, Nebraska

F:A.M.31271, cranial saddle with horns and m^1-m^3 (w++). Figs. 33, 34. m^3 base = 15.5 mm.

Cosoryx ilfonsensis, n.sp., referred, from New Mexico

F:A.M.31730, female skull with p^2-m^3 (m). $m^3 = 12.1$ mm.

C. furcatus Leidy, referred, from Midway Quarry, Cherry County, Nebraska

F:A.M.32376, posterior cranium with burred horn-cores.

F:A.M.32377, posterior cranium with burred right horn-core. Figs. 36, 36A.

C. furcatus Leidy, referred, from Gordon Creek, Cherry County, Nebraska

N.S.M.1-9-8-28, partial skull with horn and p^2-m^3 (m). Figs. 36, 36A. $m^3 = 11.5$ mm.

F:A.M.32450, immature skull and jaws, premaxilla and /dis preserved, and $dp^2-m^3_2$. Fig. 26.

F:A.M.32426, cranium with p^2-m^3 (m). Anterior muzzle missing. Specimen unique in that the pterygoids are preserved. Fig. 26. $m^3 = 10$ mm.

C. furcatus Leidy, referred, from Burge Quarry, Cherry County, Nebraska

F:A.M.32902, skull including partial premaxilla, horns and dentition (m+). Figs. 2, 37A. $m^3 = 11.5$ mm.

C. furcatus Leidy, referred, from Hitchcock County, Nebraska

A.M.8497, posterior cranium with horns. Figs. 28, 36.

C. furcatus sternbergi, n.subsp., from Kansas

F:A.M.31511, posterior cranium with horns, Figs. 28, 28A, 36, 36A, and associated ramus, Fig. 43.

C. furcatus mooki, n.subsp., from Montana

A.M.21370, portion of cranium with horns, and m^1-m^3 (w). Fig. 36A. $m^3 = 12.8$ mm.

C. (Paracosoryx) wilsoni, n.subg. and sp., from Sioux County, Nebraska

F:A.M.32470, cranium with horns, lacking anterior muzzle (m+). Fig. 37. $m^3 = 11.5$ mm.

F:A.M.31191, cranium with horns, lacking muzzle (A). Fig. 37. $m^3 = 10.5$ mm.

C. (Subparacosoryx) savaronis, n.subg. and sp., from Sioux County, Nebraska

A.M.17339, posterior cranium with horns and m^1-m^3 (w+). Figs. 28, 28A. $m^3 = 9.7$ mm.

A.M.22746, partial cranium with left horn and short-crowned m^1-m^3 (m+). Fig. 39. $m^3 = 10.4$ mm.

A.M.17340, posterior cranium without teeth.

Meryceros nenzelensis, n.sp., from Nenzel, Cherry County, Nebraska

F:A.M.31902, major portion of large crushed skull with p²-m³, and ramus with dentition (m+). Horns broken. Fig. 44 (ramus only). m³ = 13.3 mm.
F:A.M.32174, skull with horns and dentition (m+). Fig. 40. m³ = 12.8 mm.
F:A.M.32175, partial immature male skull with rudimentary core and dp²-m³ (germ) (m). Fig. 40.

M. warreni johnsoni, n.subsp., from Crookston Bridge Quarry, Cherry County, Nebraska

50 skulls or partial skulls from Crookston, 11 with attached rami, and 5 with premaxilla preserved (N.S.M.2-3-8-34, 1-27-7-34, 1-23-7-34, 3-5-9-35 and 2-15-8-35). Figs. 28B, 28C.
N.S.M.1-17-6-32, partial female skull with p²-m³ (m). Fig. 28. m³ = 10.4 mm.
N.S.M.26-17-6-32, crushed female skull with p²-m³ (w). m³ = 11.0 mm.
Two from Valentine Quarry A:
N.S.M.20-8-7-33, skull with horns and p²-m³ (A). Figs. 28, 28A. m³ = 10.1 mm.
N.S.M.16-16-6-33, anterior 1/6 female skull including premaxilla, with p²-m³ (m+). Fig. 28A. m³ = 11.3 mm.

SUMMARY OF MERYCODONTINI SPECIMENS

Genus No.		Crania	Horns	Maxillæ	Mandibles	Limbs	Total Elements	Assoc. Elements	Total Specimens
I	<i>Ramoceros</i> , n.g...	1	57[1]	[4]	[3]	15[2]	80	10	70
IA	<i>R. (Paramoceros)</i> , n.subg...	1	16[1]	[1]	6[1]	7[3]	31	6	25
IB	<i>R. (Merriamoceros)</i> , n.subg...	1	26[1]	26[1]	84	1	138	2	136
II	<i>Cosoryx</i> Leidy...	18	84[4]	50[12]	280[10]	150[5]	582	31	551
	<i>"Merycodus"</i> Leidy.....				1		1		1
IIA	<i>C. (Subcosoryx)</i> , n.subg.		89	220	758[1]	24	1091	1	1090
IIB	<i>C. (Paracosoryx & Subparacosoryx)</i> , n.subg.	20	63[7]	81[15]	491[1]	103[1]	758	24	734
IIC	<i>Meryceros</i> , n.g...	62	193[35]	94[46]	285[15]	236[6]	870	102	768
III	<i>M. (Submeryceros)</i> , n.subg...		4		14	1	19		19
IIIA	Unallocated	1		108[1]	703[1]	16[1]	828	3	825
		104	532	584	2625	553	4398	179	4219

[] associated specimens.

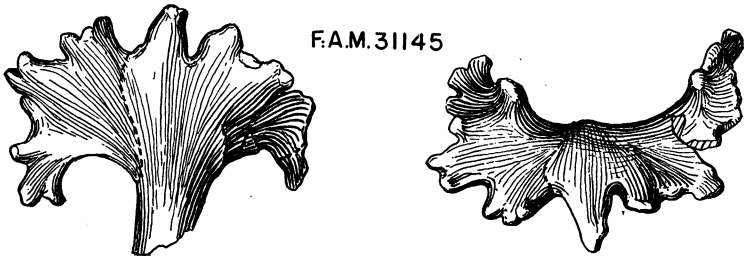


FIG. 28D. *R. (Merriamoceros) coronatus* (Merriam), ref. (F:A.M.31145), largest so-far-collected horn, from Barstow, California. (Unlisted.)
Lateral and superior views $\times \frac{1}{2}$. (See Figs. 35, 35A [in part] and page 332.)

The characters of the mandible and dentitions are partially résumé on page 313, and those of the skeleton on page 316.

Distribution of Genera and Subgenera

As judged by specimens of the "horns" in the Late Tertiary of:

(1) NEW MEXICO [large collections]—

Ramoceros and

Meryceros, of several variations, are common from the Santa Cruz area, and present at Ojo Caliente and Skull Ridge; *Cosoryx* (the predominant Niobrara, Nebraska, form), is relatively scarce, though the peculiar *Subcosoryx* is well represented at the type locality;

Paramoceros is known only from Pojuaque; and

Submeryceros is extremely rare.

(2) COLORADO [small collection]—

Ramoceros, *Cosoryx*, *Meryceros* and *Submeryceros* are all represented.

(3) KANSAS, SOUTH DAKOTA AND MONTANA [even smaller collections]—

Except for the single example of *Paramoceros*, *Cosoryx* is the only form that has so far been found.

(4) NEBRASKA [large Nenzel, Gordon Creek, Midway and Crookston series]—

Ramoceros (Fairfield Creek, Brown County and south Hitchcock County), and

Paramoceros (Dutch Creek, Brown County) are rare;

Cosoryx seems to have been the predominant form, being represented from some nine localities, including the Gordon Creek, Swallow and Midway Quarries of northern, and Hitchcock County deposits of southern, Nebraska;

Paracosoryx is limited to Sioux County and Dawes County;

Subparacosoryx is recognized alone from Sioux County; and

Meryceros is confined to a few localities in the vicinity of the Niobrara, more notably Crookston Bridge and Nenzel of Cherry County; and to a single occurrence in Dawes County.

(5) CALIFORNIA [large collections from Barstow]—

Paramoceros from the upper beds and *Merriamoceros* from the Second Division are extremely rare;

Paracosoryx replaces *Cosoryx* and, like the following genera—

Meryceros and *Submeryceros* (rare)—

is known only from the uppermost horizons;

Barstow thus witnessing a somewhat different assemblage from that of the Rocky Mountains.

(6) NEVADA [fragmental only]—

Paracosoryx, referred, and *Meryceros* are recognized.

(For mandibular dentitions considered according to above areas, see page 373.)

Although no definitely known form has been recognized in the Middle Tertiary,¹ the Merycodontini, as shown above, were widely dispersed in the North American Late Tertiary. (While unreported from Eurasiatic localities, it is doubtfully possible that certain fragmentary specimens from the European Miocene, at present identified with *Dicrocerus* Gervais, may be found referable to this division.)

The several more widely disseminated Merycodontine groups may well prove of assistance as time markers in the correlation of Late Tertiary strata. The predominance² of *Cosoryx* over *Meryceros* and the rarity of *Ramoceros* in Nebraskan deposits, the commonness of *Ramoceros* and *Meryceros* relative to *Cosoryx* in the case of New Mexico, and the predominance of *Meryceros* and *Paracosoryx* in the case of California, seem more than chance coincidence. The wide separation of certain forms of the Mojave Desert and of the Great Plains areas is worthy of note. Notable also is the evident absence of representatives of the division from the relatively late horizons represented by the Xmas Quarry of Cherry County, Nebraska, and Clarendon of Texas, and its possible absence from the earlier Sheep Creek and Devil's Gulch deposits of

¹ Cook, Harold J. and Margaret C., 1933, Nebr. Geol. Surv., Paper No. 5, p. 30, mention *Merycodus* as occurring in the Upper Harrison.

Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 161, Pl. III, Fig. 7, describes and figures, "Two second upper molars, from a single individual, from a badly disintegrated skull" (HC512), from the Upper Harrison of Nebraska, as the type of a new species, *Merycodus prodromus*. The author's figure, and statement, "Smaller than any described species of *Merycodus*, with somewhat less hypsodont molars than those of the known, and geologically later, species of the genus," suggest that the teeth are actually of some other group than the Merycodontini.

² 537 *Cosoryx* specimens are listed in these pages, from twenty-six localities, and 538 *Meryceros* specimens, from thirteen localities in Nebraska.

Nebraska. As elsewhere remarked, the northern Nebraska deposits yielding *Cosoryx*, as so far observed, seem to be stratigraphically higher than those that yield *Meryceros*. *Subcosoryx* occurs near the very top of the main Tertiary of the New Mexican area. Moreover, there is a distinct absence of remains of the Merycodont group from those evidently later localities yielding *Texoceros*, n.g.—such as Guymon, Oklahoma; Miami, Texas; and Yuma County, Colorado.

FOUR SPECIES OF SIOUX COUNTY, NEBRASKA

The difficulty in the determination of the number and sequence of forms at any one locality is exemplified in the case of the long-collected deposits of Sioux County, where there is question as to whether the Merycodontines occur at a single horizon or in both the so-called Snake and Sheep Creek. Some four or five species seem to be represented—

Two species are recognized in the horns (reconstructions, Fig. 27, AA and B):

Paracosoryx wilsoni—Tall-shafted horn-cores and limbs from Long Quarry—metapodials smaller than Size Group IV. And

Subparacosoryx savaronis—Unusually small-horned crania from Sinclair Draw, apparently accompanying limbs of Size Group IV. The same may prove synonymous with *Paracosoryx sabulonis* (Matthew and Cook), see below. And

Four species are distinguishable in the mandibular rami:

Paracosoryx wilsoni, referred—Short-diaestemaed specimens typical of the area and of the Wilson Long Quarry.

Paracosoryx sabulonis (Matthew and Cook)—The type is a ramus from Sinclair Draw which may prove to be of the form represented by the small crania from that area, in which case the species would supplant *S. savaronis*.

Cosoryx furcatus var., referred, Size Group III—Type ramus closely resembles Garman specimen (M.C.Z.10101) and indicates a similar large *C. furcatus*-like horn. A few large limbs (Size Group III) are tentatively referred.

(?) *Submeryceros minor serpentinus*, Size Group VI—Horns as yet unknown.

The above-noted Sioux County Merycodontine horns are of two distinct forms of generalized *Cosoryx* pattern and tend to differ from the Great Plains species in the extreme height of the shaft in the case of the one, and in the smallness of horns and crania in the case of the second. The burr in both species (when retained) is situated unusually high above the orbit, and the points of the fork are short and strongly bent inwardly, the posterior point tending to be longer than the anterior. [In one of the long-shafted specimens the crotch is peculiarly flattened and the points are laterally expanded—versus the reduction of the cross section of the

crotch and shortness of the points in the remainder of the same *Paracosoryx wilsoni* series (see Fig. 26 versus 37).]

None of the mandibular rami of the large series derived from the same Sioux County exposures has been found directly attached to skulls, but the rami, in their short diastemata, are quite as characteristic as any of the horns. It is presumed that the larger and smaller rami (Size Groups III–IV) and notably small limb elements (Size Groups IV and V) from the Wilson horizons represent no more than individual variation within the *P. wilsoni* species. The rather similar but slighter type ramus of *Paracosoryx sabulonis* (Matthew and Cook) and other slender-proportioned rami may possibly represent the species of the small crania likewise secured from Sinclair Draw by Albert Thomson. The single elongate Sioux County ramus of the Princeton collection differs from all the above, both in the elongation of the diastema and general large size (Size Group III), and closely approximates the Museum of Comparative Zoology Garman ramus associated with the *Cosoryx furcatus* horns, described by W. B. Scott (1890). A few distinctly smaller Merycodontine rami (Size Group VI) from the Wilson horizons are referred to (?) *Submeryceros minor serpentinus*. (Recently secured remains from Ginn Quarry, Dawes County, Nebraska, include a few horn-cores and mandibular rami with short-proportioned diastemata closely resembling the Sioux County *Paracosoryx*.)

William D. Matthew (1924), in a résumé of the available evidence, tabulates *M. necatus* and *M. necatus* var. *sabulonis* as occurring in both the Sheep Creek and Lower Snake Creek, and the slightly larger (?) *T. (M.) altidens* as occurring alone in the Upper Snake Creek or *Hipparion* Zone. (p. 198) "... *Merycodus* is fairly common in the *Merychippus primus* zone, this being the earliest record of its occurrence. The upper and lower jaws, limb and foot bones do not show any uniform distinctions from the more abundant material secured in the *M. paniensis* zone. It is quite possible that skulls or antlers might show such distinctions. *Merycodus* appears at this point as an invading immigrant, so far as we can judge. There is nothing in the extensive and well studied fauna of the Lower Miocene that could stand as ancestral to it. It appears suddenly, just as *Blastomeryx* appears suddenly at an earlier point (Upper Rosebud and Upper Harrison)." Matthew notes (1909) that a large series of Sioux County limb and foot bones, A.M. 14125 and 14132, agree pretty nearly in size with *R. osborni* except that the fore limb bones (and jaw) are somewhat smaller; and further that a series of rami, A.M. 14102–17, run uniformly smaller and slenderer than Leidy's specimen.

Through non-association of teeth, limbs and horns (as noted above), it is impossible in cases to definitely allot the two former to the genera and subgenera, based primarily on the character of the horns. To facilitate further study and the comparison of future discoveries, the Merycodontine horns, teeth and limbs which have been available to the writer are carefully enumerated in three separate sections with cross-references in the case of associated remains. The horns are listed according to large, medium and small under the nine genera and subgenera and thirty-four species and subspecies, and the dentitions and limb elements are referred to the same and ten additional species and subspecies, divided between six size groups (which parallel Size Groups II-VII of the Blastomerycine section).

Subfamilies, Genera and Subgenera as Viewed in "Horns"

(See Details, Section II, Page 323)

The three here recognized Merycodontine genera and six subgenera (see Figs. 26, 28-40 and reconstructions, frontispiece, A, and Fig. 27) are based largely on characters of the "horns." These nine subdivisions form a ready means of grouping the forty-four¹ listed species and subspecies, many of which are based at present mainly on occurrence.

SUBFAMILY 1.—RAMOCEROTINÆ

I. *Ramoceros*, new genus, and two subgenera:

The genus is characterized by the depressed postorbital position of the three- to four-pointed "antlers," which are of remarkably Cervine appearance; the basal "pedicle" is depressed and directed outwardly and posteriorly; the tips (not always symmetrical) flare widely; the shafts are slender with circular-tending cross section and are deeply curved anteriorly.

Ramoceros Proper

(Genotypic Species *R. ramosus* (Cope), from New Mexico)

The shaft is long, with a forwardly directed prong ("brow tine") at two-thirds distance above the base, and distally is bi- or tri-forked.

¹ Thirty-one species and subspecies are based on horns, one on skull and skeleton and twelve on dentitions. Three of the latter include referred horns. Of the forty-four species, thirty-eight are named. Including three unnamed vars., there are listed (p. 317) forty-seven species, subspecies and vars.

This surprising genus is well represented in our New Mexican collection (typical specimens figured by Cope, 1877, under *Dicrocerus furcatus* Leidy); and is known by the mounted skeleton from Colorado (the type of *M. osborni* Matthew, 1904), and by an antler from Hitchcock County, Nebraska. (See figured growth stages of New Mexican horns, Figs. 29–32.)

IA. *Paramoceros*, new subgenus

(Subgenotypic Species *R. (P.) brevicornis*, from Barstow, California)

The main shaft is short (in the California subgenotype) to long (in Rocky Mountain variation) and the secondary shaft is reduced, the lower and two terminal prongs simulating a tri-pointed crotch. The subgenus is well represented in the variation from New Mexico; is known in partial crania from Brown County, Nebraska (F:A.M.31271) and Kansas (F:A.M.31510); and is typified in the interesting subgenotypic specimen from Barstow, California (F:A.M.31348), in which the shaft is erect and much shorter than in the foregoing. (See figured growth stages in New Mexican series, Figs. 33, 34.) An apparently related adaptation with distinctly palmate crotch is exemplified by a single horn-core from New Mexico (F:A.M.31580).

IB. *R. (Merriamoceros)*, new subgenus

(Subgenotypic Species *R. (M.) coronatus* (Merriam), from California)

The "horns" are remarkable for their small size, tendency to palmation and multitubercular pointing. They recall, in minor measure, miniature moose antlers (Figs. 28D, 35, 35A). A crushed skull recently has been added to the collection. The mandible is slender, the diastema short and the p_2 proportionately large. In a single and unique specimen (F:A.M.31144, Fig. 47A) the p_1 (dp_1) is retained.

SUBFAMILY 2.—COSORYCINÆ

II. *Cosoryx* Leidy (1869) and three subgenera:

The horns are single-forked, erect and supra-orbital, with tall slender shafts of circular cross section, the shaft tending to be differentiated from the basal pedicle, tilted slightly forwardly and outwardly, and rotated so that the longer anterior points are directed inwardly.

Cosoryx Leidy, Proper(Genotypic Species *C. furcatus* Leidy, from the Niobrara)

Described in 1869 on a partial horn-core, the genus is now well represented by specimens from several different areas. The horns exhibit a great range in size. While certain dimensional differences may prove specific, the specimens are tentatively interpreted as largely representing growth differences. Certain less typical horns approach in form specimens here referred to the following *Meryceros* group. *Cosoryx*, should *Merycodus* ever be definitely determined (elsewhere discussed), may prove to be a synonym of the latter. *Cosoryx* proper is widely distributed in the upper levels of the Great Plains deposits. The largest horns are found in the collection from New Mexico, and smaller-sized examples in the series from the Midway Quarry, Nebraska, and in a single small-horned cranium from Montana. The series of horns probably include several growth stages. They may be divided tentatively between larger and smaller, the more moderate being exemplified by the *C. furcatus* Leidy Niobrara type horn. A few less typical specimens approach certain specimens here referred to the following genus, *Meryceros*. The average of the horns does not differ materially from the reduced-premolar *Subcosoryx*. In Sioux County, Nebraska, and the Mojave Desert, California, *Cosoryx* is replaced by the abbreviated-diastemated *Paracosoryx*. In this the burr tends to be situated higher on the shaft, which is typically slender and extremely elongate, and the points are reduced and recurved, the posterior being the longer. In the smaller of the species from Sioux County the shaft is noticeably short.

IIA. *Subcosoryx*, new subgenus(Subgenotypic Species *C. (S.) cerroensis*, from Santa Fé, New Mexico)

Premolars greatly reduced. The large series of horns from the type locality exhibit considerable variation in form (see below).

IIB and C. *Paracosoryx* and *Subparacosoryx*, new subgenera(Subgenotypic Species *C. (P.) wilsoni* and *C. (S.) savaronis*, from Sioux County, Nebraska)

Diastema short, premolars large; burrs set high, shafts elongate (*Paracosoryx*) or short (*Subparacosoryx*).

III. *Meryceros*, new genus, and one subgenus:

The genus is characterized by forked supra-orbital and laterally compressed horns or horn-cores. Certain questioned specimens seem to be partially intermediate to the more typical *Meryceros* forms and to *Cosoryx-Paracosoryx*. Such horn-cores are exemplified in certain large specimens from New Mexico, California and Nebraska (page 354).

Meryceros

(Genotypic Species *Cervus warreni* Leidy, 1858, from the Niobrara, Nebraska)

Horn-cores may be tentatively divided according to individual form between horns taller and less compressed, and resembling certain specimens here referred to *Cosoryx*; horns more compressed with non-divergent points (not unsuggestive of the Antilocaprine *Stockoceros*); and *Meryceros* proper, horns shorter with variably compressed and more wedge-shaped shafts. While certain of the *Meryceros* horns are particularly suggestive of *Stockoceros*, n.subg., of the Pleistocene, the similarity is not real, the latter bearing a definitely burrless horn-core. (It is yet to be demonstrated to what degree the great size differences occurring in the material are due to growth stages, individual variation or specific difference.) *Meryceros* horn characters are discussed in greater detail below, under the remains from Crookston Bridge and Nenzel Quarries. The diastemata and muzzle are long.

IIIA. *Submeryceros*, new subgenus

(Subgenotypic Species *M. (S.) crucianus*, from Santa Cruz, New Mexico)

Diminutive, forked horns, peculiar in that burrs are developed separately on each fork instead of basally on the central shaft. Exemplified in a few specimens from Santa Cruz, and in the specimen figured by Cope (1877, Pl. LXXXI, Fig. 4), from an adjacent area. Tentatively referred species rest on several rare mandibular specimens of Size Groups vi-vii from Nebraska and Colorado.

Five historic species based on horn specimens are readily identifiable through specimens in the present collections, viz.: *Cosoryx ramosus* Cope, from New Mexico, equals *Ramoceros ramosus* (Cope); *Merycodus osborni* Matthew, from Pawnee Creek, equals *Ramoceros osborni* (Matthew); *Merycodus coronatus* Merriam equals *R. (Merriamoceros) coronatus* (Merriam); *Cosoryx furcatus* Leidy, from the Niobrara, is abundantly represented; and *Cervus warreni* Leidy equals *Meryceros warreni* (Leidy). Compare indeterminate species, page 315.

As above noted, the some five hundred examples of horns (including one hundred and ninety-three on crania or partial crania) are listed in Section II, "Horns," under the nine genera and subgenera and thirty-eight species and unnamed vars., which are subdivided according to local occurrence and cross-referenced when associated with other remains.

Outstanding examples of the several "horn" forms are figured in the following series of seventeen plates, Figures 29–40 inclusive.

FIGS. 33 AND 34. *R. (Paramoceros)*, n.subg., individual and age variation in horns from the Late Tertiary of New Mexico and Nebraska.

Posterior and lateral views $\times \frac{1}{2}$.

F:A.M.31619 and 31624, rev., and 31620, type, of *R. (P.) marthæ*, n.sp., from New Mexico.

(See pages 330, 329.)

F:A.M.31271, *R. (P.) howardæ*, n.sp., type, from Dutch Creek, Brown County, Nebraska.

(See page 330.)

F:A.M.31580, *R. (P.) palmatus*, n.sp., type, from New Mexico.

(See page 331.)

FIG. 35. *Meryceros*, n.g., *M. (Submeryceros)*, n.subg., *R. (Paramoceros)*, n.subg., and *R. (Merriamoceros)*, n.subg., comparison of horns from the Late Tertiary of New Mexico and California.

Lateral and posterior views $\times \frac{1}{2}$.

F:A.M.32810, *Meryceros joraki*, n.sp., ref., from Barstow, California.

(See page 369.)

F:A.M.31495, subgenotype, 31496 and 31497, *M. (Submeryceros) crucianus*, n.subg. and sp., from Santa Cruz, New Mexico.

(See page 370.)

F:A.M.31348, subgenotype, rev., and 31349, *R. (Paramoceros) brevicornis*, n.subg. and sp., from Barstow, California.

(See page 331.)

F:A.M.31350 and 31351, *R. (Merriamoceros) coronatus* (Merriam), ref., from Green Hills, Barstow, California.

(See page 333.)

FIG. 35A. *Meryceros*, n.g., and *R.* (*Merriamoceros*), n.subg., comparison of horns and mandibular rami from the Late Tertiary of California (and N.S.M. horns from Nebraska).

Lateral and superior views of horns and lateral views of rami $\times \frac{1}{2}$; occlusal view of ramal dentition $\times 1$. PS, posterior border symphysis.

F:A.M.31019 (rev.) and 31020, ref. mandibular rami; 31022 (rev.), 31024A (rev.), 31146 (rev.) and 31177 (var., rev.), ref. horns, *R.* (*Merriamoceros*) *coronatus* (Merriam), from Barstow, California.

(See pages 437, 333.)

F:A.M.32822 and 32811, *Meryceros joraki*, n.sp., ref., from Barstow, California.

(See page 369.)

N.S.M.2-5-9-35 and 7-7-9-34, *Meryceros warreni johnsoni*, n.subsp., ref., from Crookston Bridge Quarry, Cherry County, Nebraska.

(See page 364.)

FIGS. 36 AND 36A. *Cosoryx* Leidy, comparison of horns and posterior crania from the Late Tertiary of Nebraska, Montana, Kansas, Colorado and New Mexico.

Lateral and posterior views $\times \frac{1}{2}$.

FIG. 36. N.S.M.1-9-8-28, *C. furcatus* Leidy, ref., from Gordon Creek, Cherry County, Nebraska.

(See also Fig. 36A and page 341.)

A.M.8497, *C. furcatus* Leidy, ref., from Driftwood Creek, Hitchcock County, Nebraska.

(See also Fig. 28 and page 344.)

F:A.M.31511, *C. furcatus sternbergi*, n.subsp., type (in part), from Kansas.

(See also Figs. 28, 28A, 36A; ramus, Fig. 43; and page 344.)

F:A.M.32377, *C. furcatus* Leidy, ref., rev., from Midway Quarry, Cherry County, Nebraska.

(See also Fig. 36A and page 340.)

F:A.M.31296, *C. furcatus* var., ref., immature, from Pawnee Creek, Colorado.

(See also Fig. 36A and page 347.)

F:A.M.31435, *C. ilfonsensis*, n.sp., type, from San Ildefonso, New Mexico.

(See also Fig. 36A and page 339.)

F:A.M.31272, *C. furcatus* Leidy, ref., from Long Pine, Brown County, Nebraska.

(See also Fig. 36A and page 343.)

FIG. 36A. Specimens of Fig. 36 (excepting A.M.8497), and:

A.M.21370, *C. furcatus mooki*, n.subsp., type (in part), from Montana.

(See page 345.)

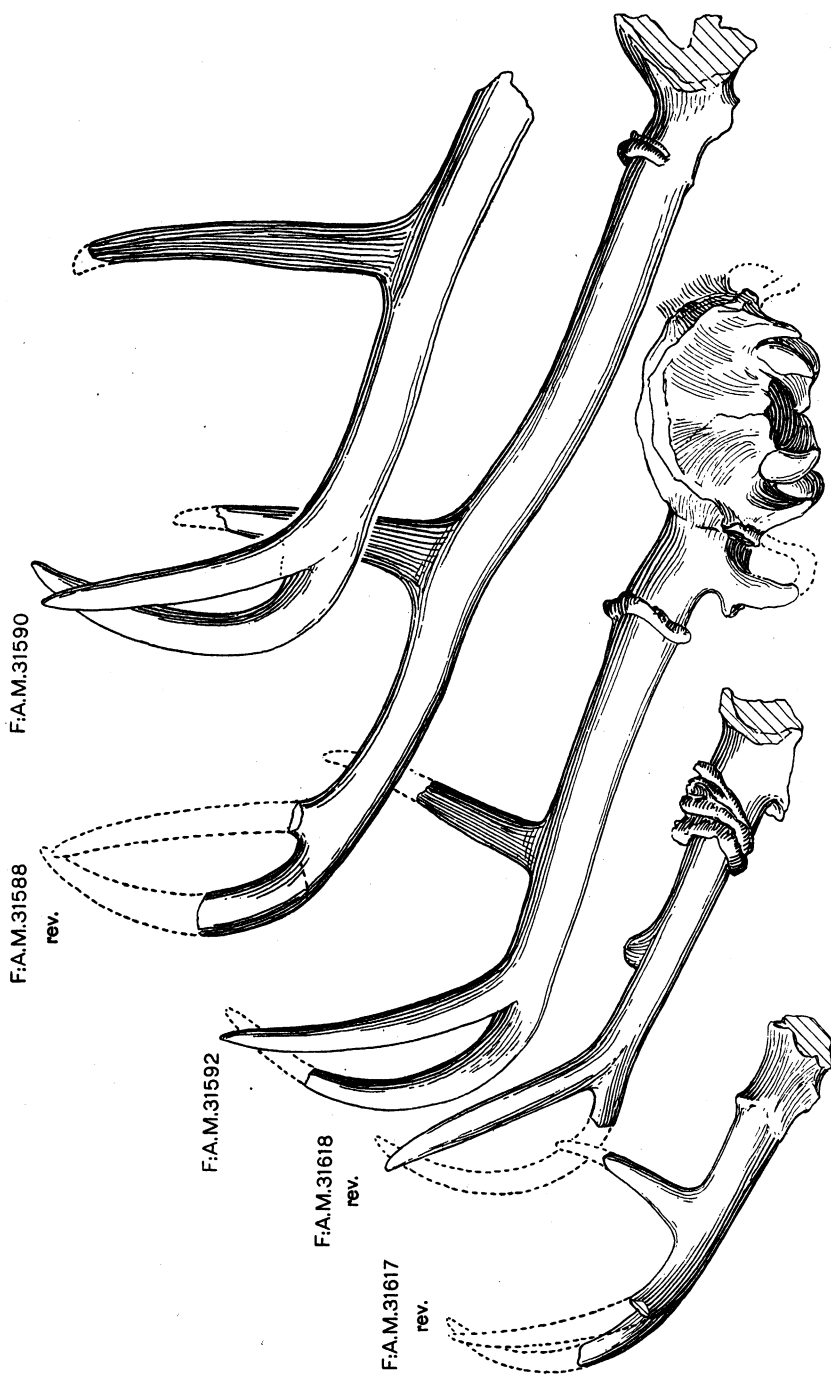


FIG. 29. *Ramoceros ramosus* (Cope), individual and age variation in ref. horns (F.A.M.31617 [rev.], 31618 [rev.], 31592, 31588 [rev.] and 31590), from the Late Tertiary of New Mexico. Posterior views $\times \frac{1}{2}$. (See also Fig. 30 [lateral views, opposite]; Figs. 26B, 28, 28A, 48 [partial manus, cranium, limbs of F.A.M.31592]; and pages 326, 327, 324.)

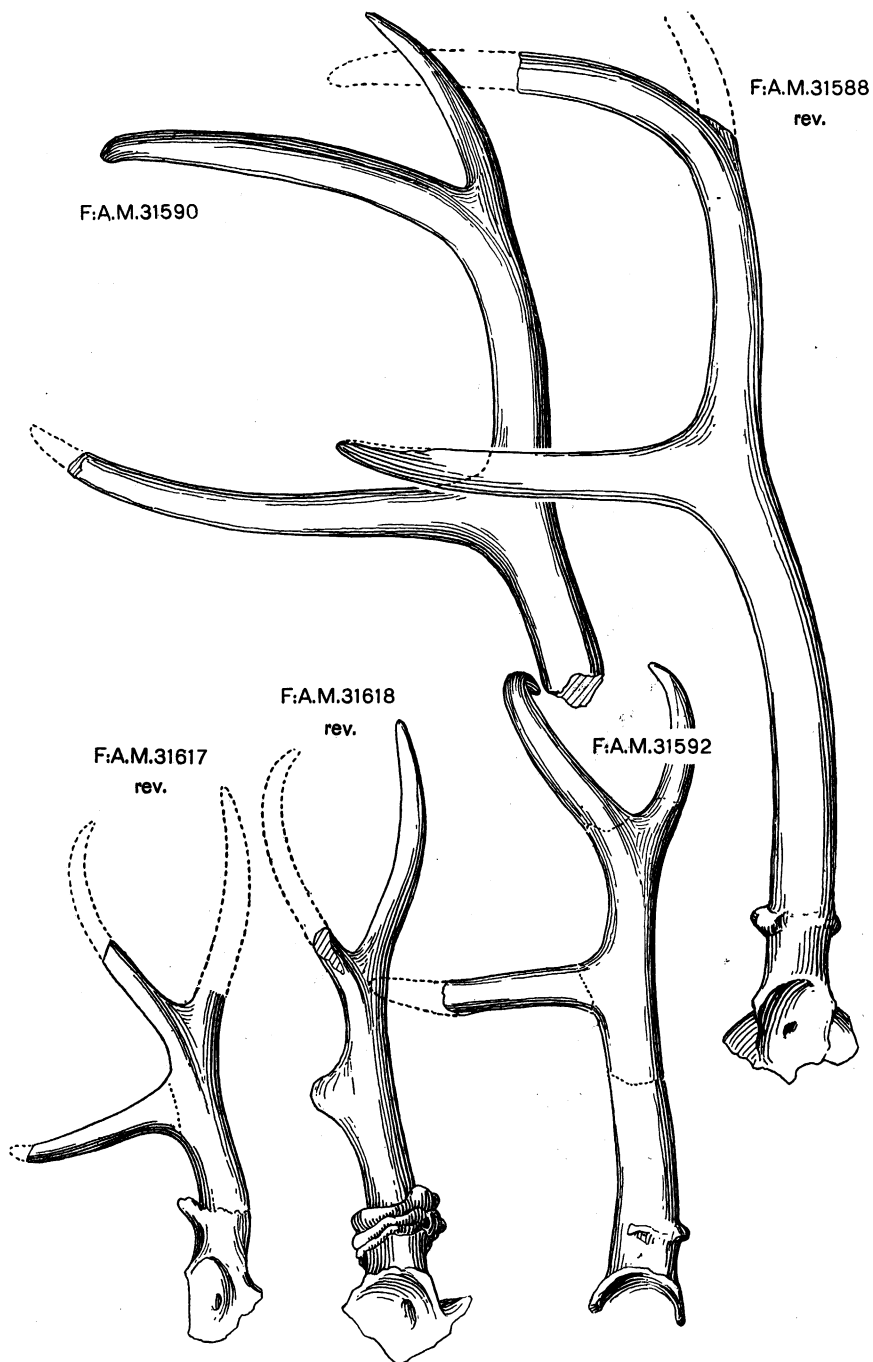


FIG. 30. *Ramoceros ramosus* (Cope), individual and age variation in ref. horns from the Late Tertiary of New Mexico.
Lateral views $\times \frac{1}{2}$ of five horns of Fig. 29 (opposite).

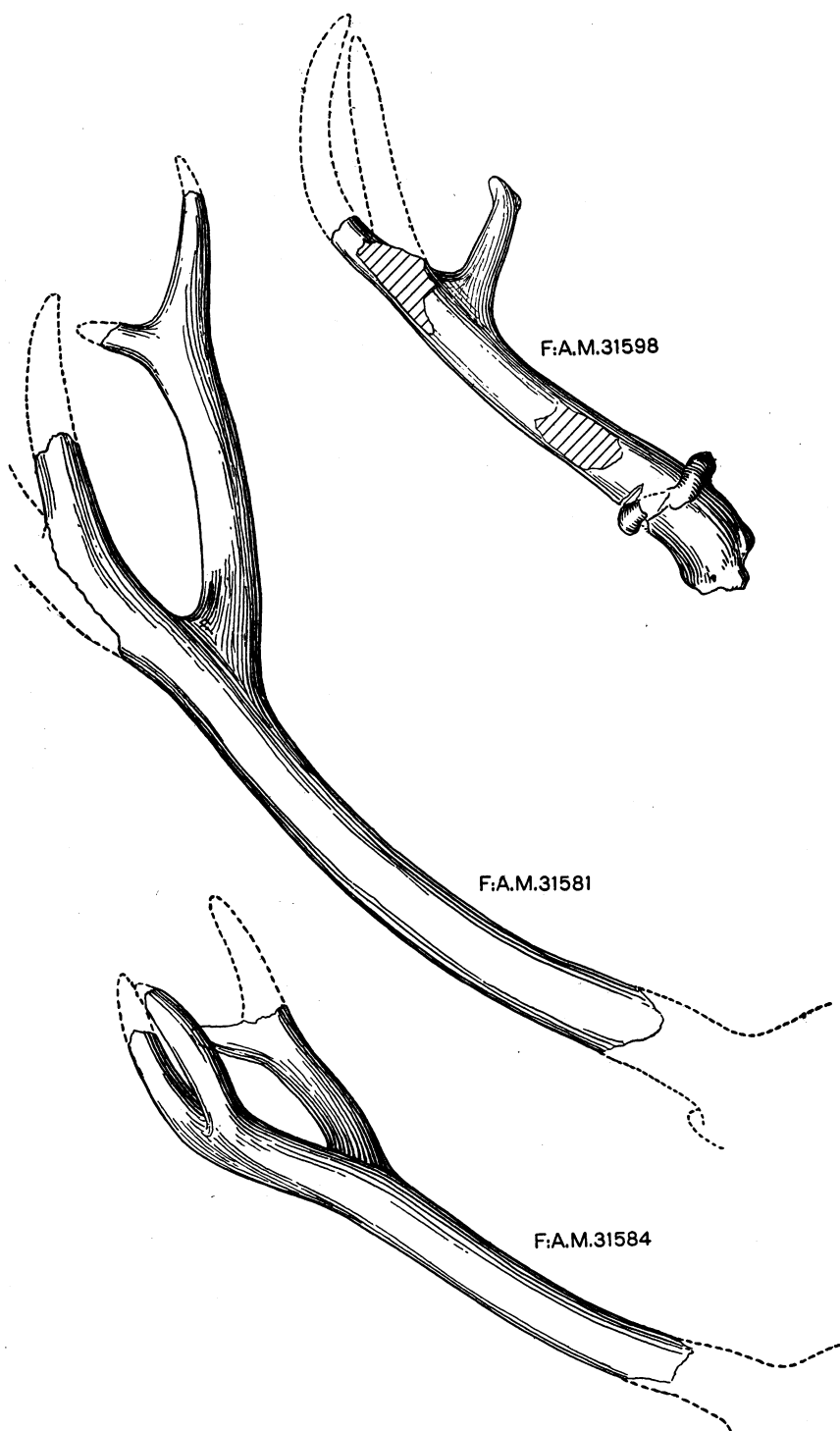


FIG. 31. *Ramoceros ramosus quadratus*, n.subsp. (F:A.M.31598 with fourth point "budding," 31581, type, and 31584), individual and age variation in horns from the Late Tertiary of New Mexico.

Posterior views $\times \frac{1}{2}$. (See also Fig. 32 [lateral views, opposite] and pages 328, 327.)

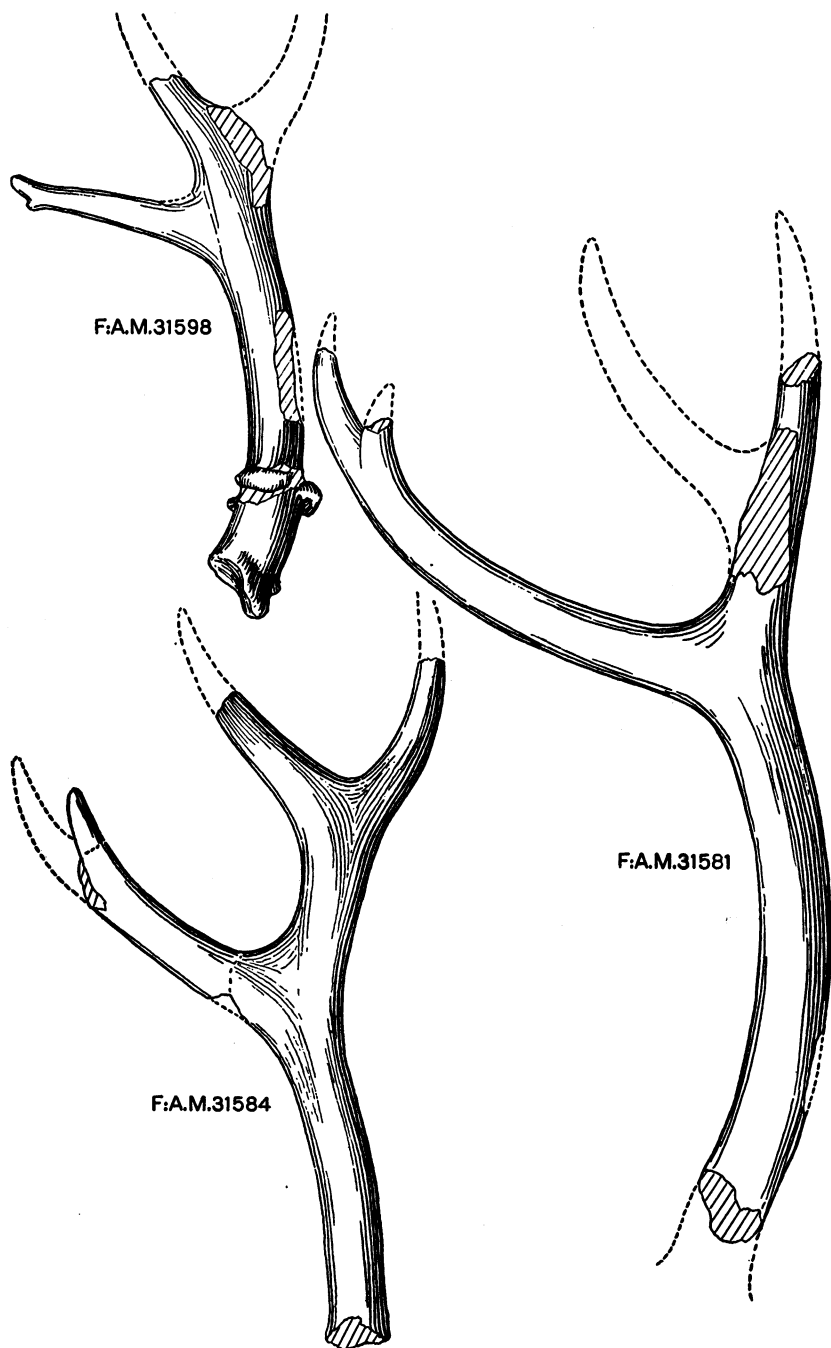


FIG. 32. *Ramoceros ramosus quadratus*, n.subsp., individual and age variation in horns from the Late Tertiary of New Mexico.
Lateral views $\times \frac{1}{2}$ of three horns of Fig. 31 (opposite).

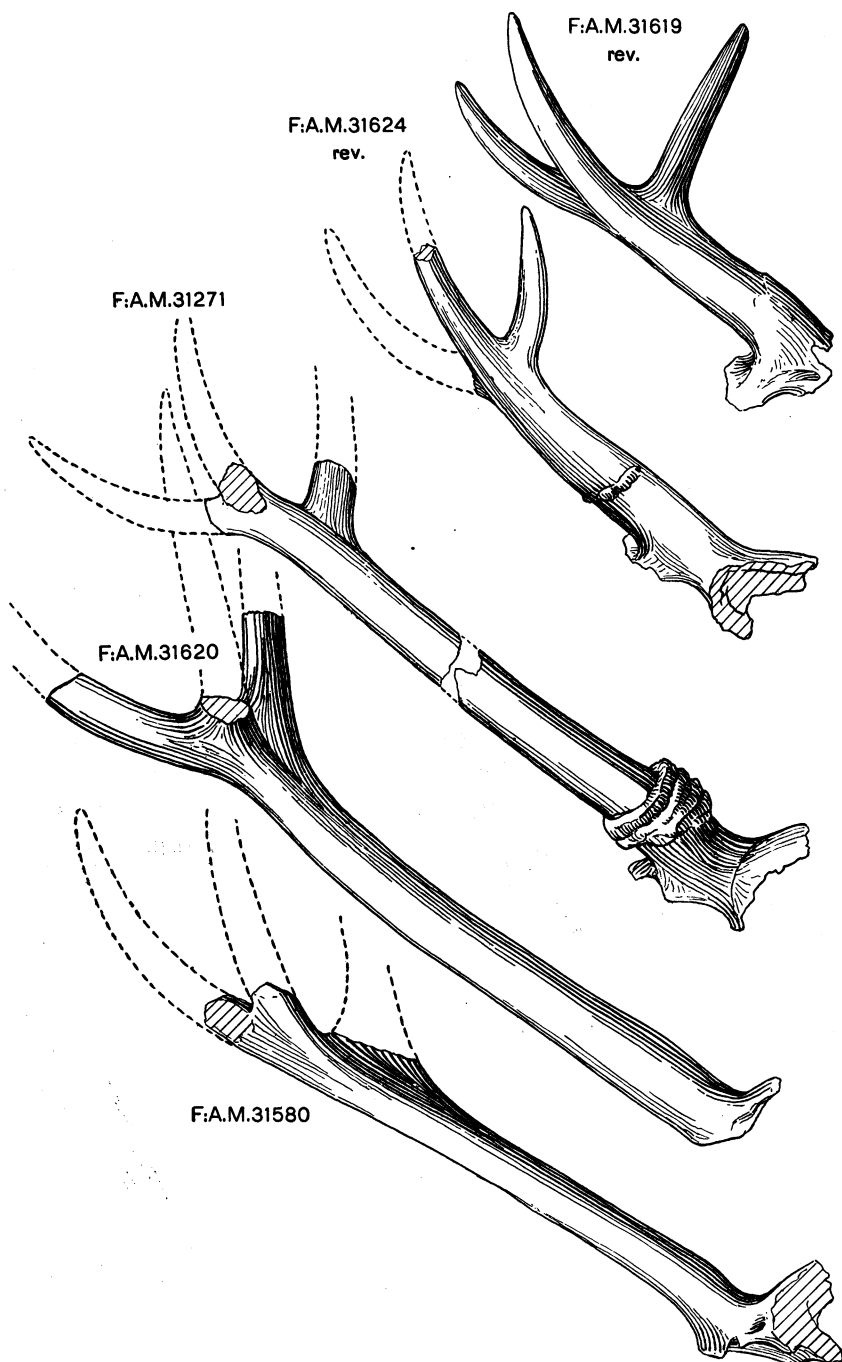


FIG. 33. *R. (Paramoceros)*, n.subg., individual and age variation in horns from the Late Tertiary of New Mexico and Nebraska.
Posterior views $\times \frac{1}{2}$. (See also Fig. 34 [lateral views, opposite] and legend, page 294.)

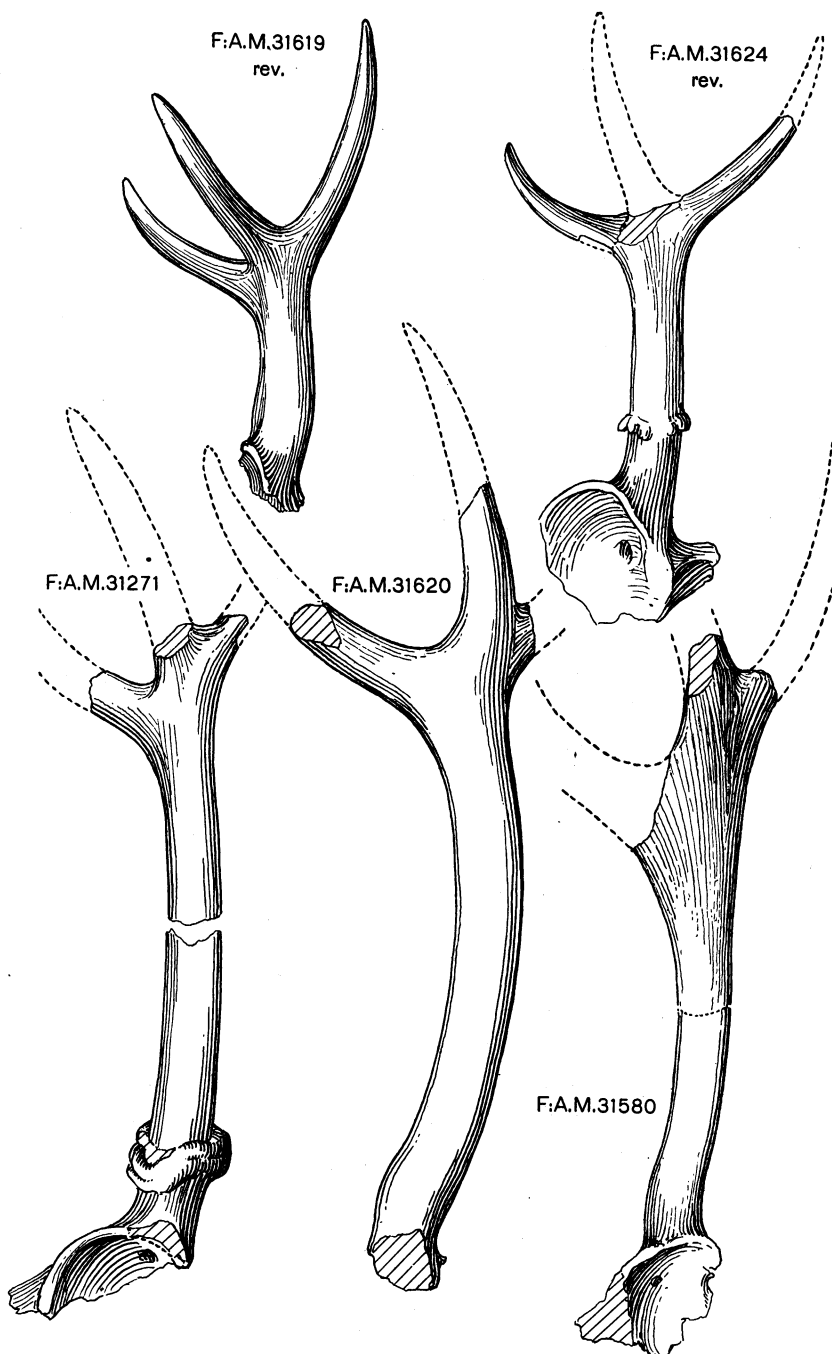


FIG. 34. *R. (Paramoceros)*, n.subg., individual and age variation in horns from the Late Tertiary of New Mexico and Nebraska.

Lateral views $\times \frac{1}{2}$. (See also Fig. 33 [posterior views, opposite] and legend, page 294.)

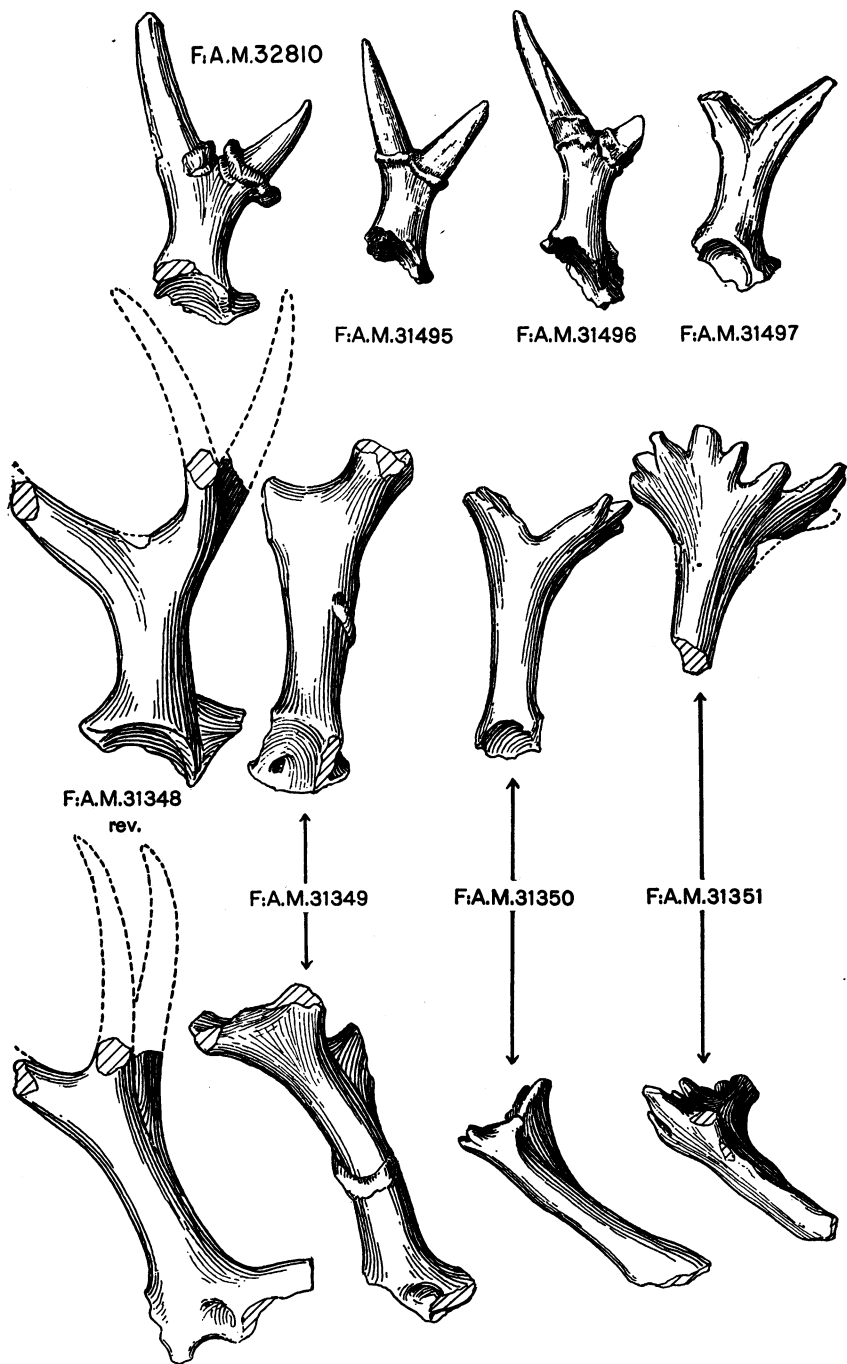


FIG. 35. *Meryceros*, n.g., *M.* (*Submeryceros*), n.subg., *R.* (*Paramoceros*), n.subg., and *R.* (*Merriamoceros*), n.subg., comparison of horns from the Late Tertiary of New Mexico and California.

Lateral and posterior views $\times \frac{1}{2}$. (See legend, page 294.)

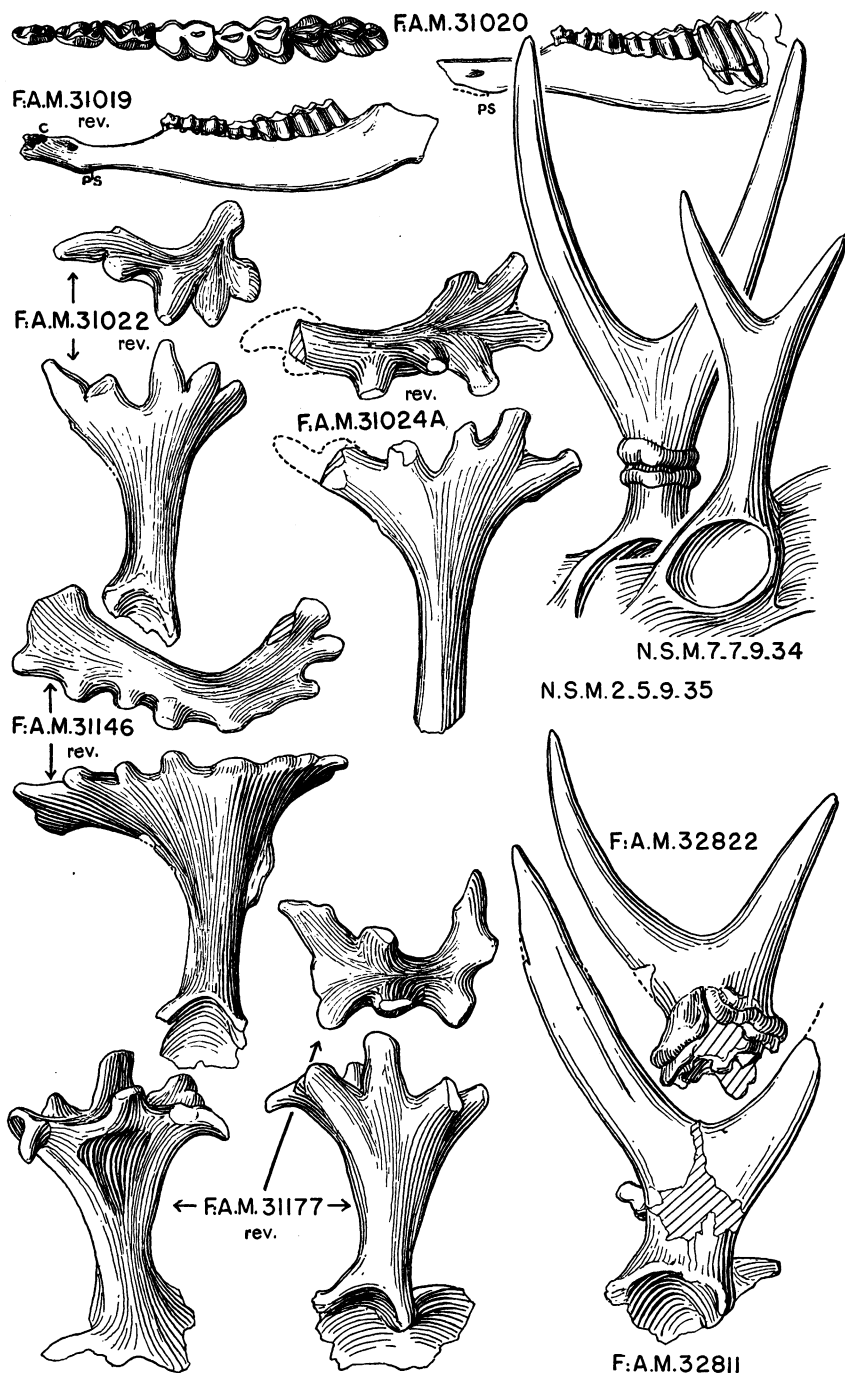


FIG. 35A. *Meryceros*, n.g., and *R. (Merriamoceros)*, n.subg., comparison of horns and mandibular rami from the Late Tertiary of California (and N.S.M. horns from Nebraska).

Lateral and superior views of horns and lateral views of rami $\times \frac{1}{2}$; occlusal view of ramal dentition $\times 1$. (See legend, page 295.)

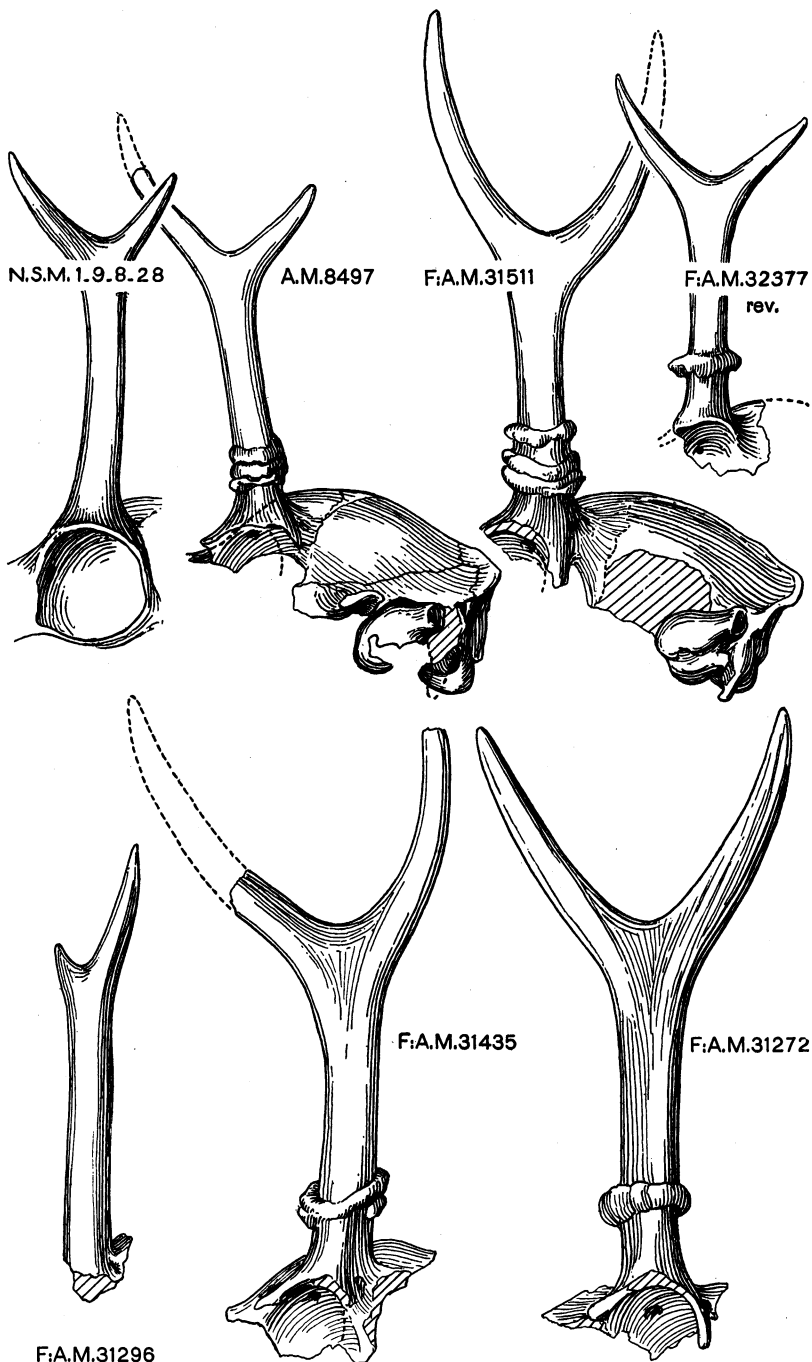


FIG. 36. *Cosoryx* Leidy, comparison of horns and posterior crania from the Late Tertiary of Nebraska, Kansas, Colorado and New Mexico. Lateral views $\times \frac{1}{2}$. (See also Fig. 36A [posterior views, opposite, excepting A.M.8497] and legend, page 295.)

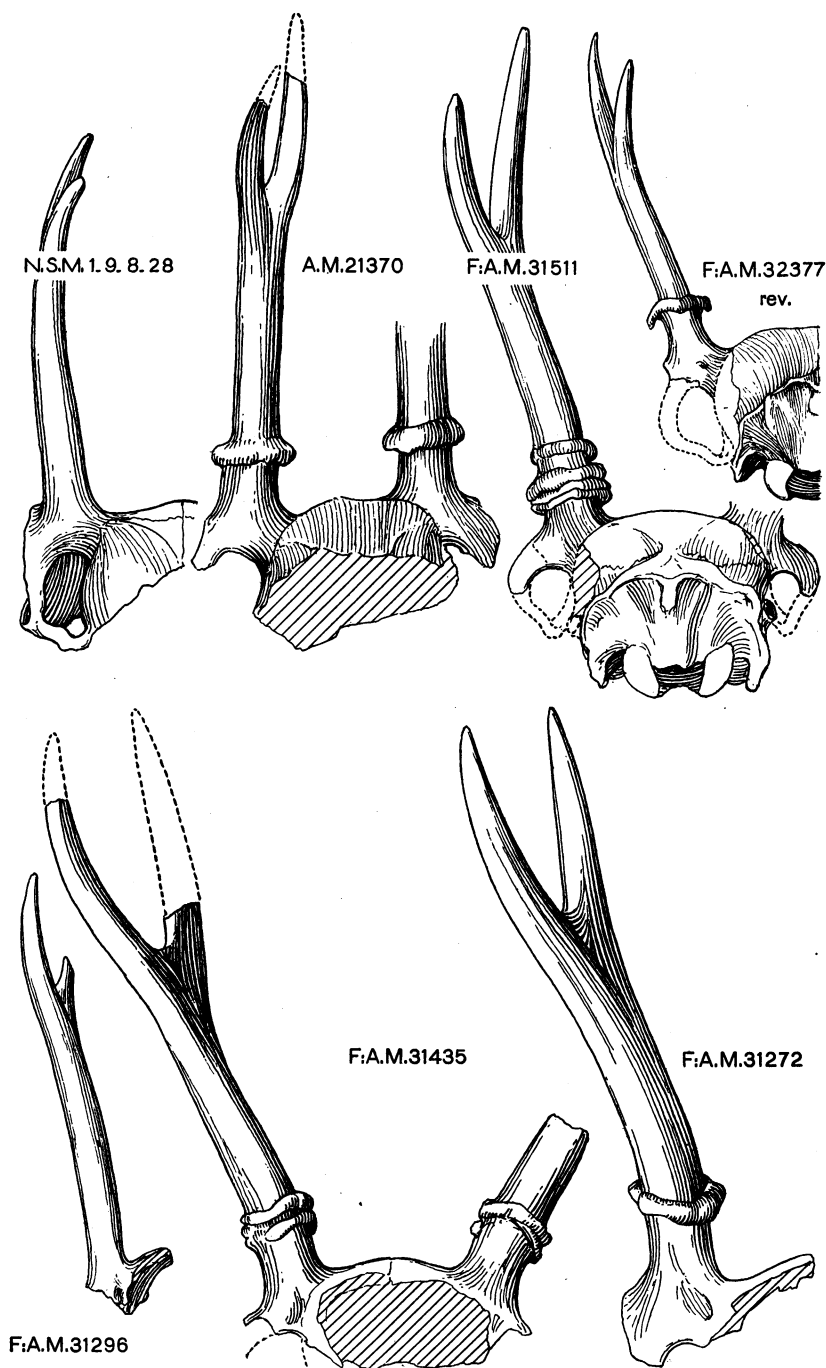


FIG. 36A. *Cosoryx* Leidy, comparison of horns and posterior crania from the Late Tertiary of Nebraska, Montana, Kansas, Colorado and New Mexico. Posterior views $\times \frac{1}{2}$. (See also Fig. 36 [lateral views, opposite, excepting A.M.21370] and legend, page 295.)

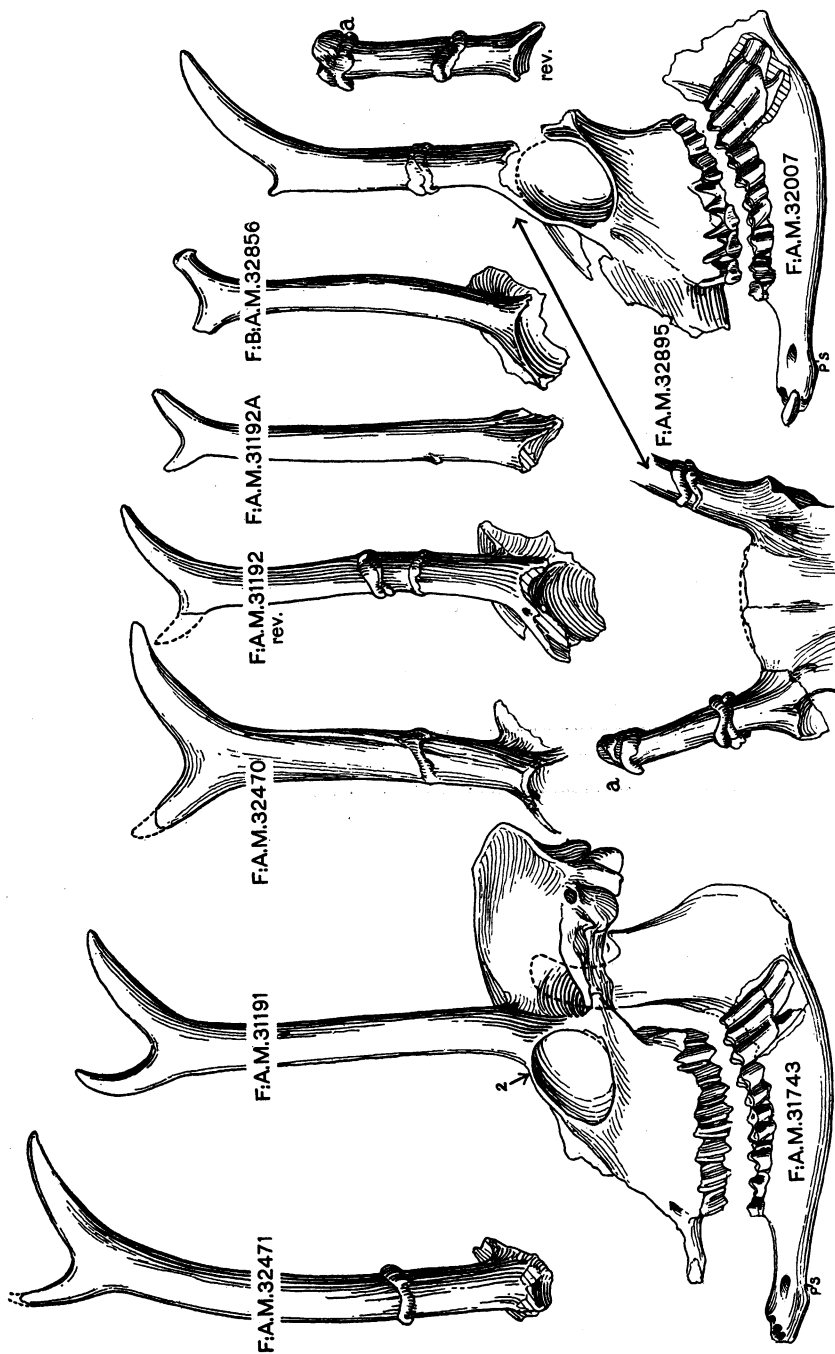


Fig. 37. *C. (Paracosoryx) wilsoni*, n.subg. and sp. (F.A.M. 32471, 31191, 31743 [var. B], 32470 [subgenotype, in part], 31192 [rev.], 31192A [adolescent], 32895 [unsymmetrical horns and burrs; a = right horn, rev.], and 32007 [var. C], age and individual variation in skulls, horns and mandibular rami, from Sioux County, Nebraska; and *C. (P.) dawesensis*, n.sp., type (F.A.M. 32856), from Dawes County, Nebraska (Late Tertiary).

Lateral views (and one anterior) $\times 4$. PS, posterior border symphysis; 2, supra-orbital foramen. (See pages 351, 352, 354, 429, 430.)

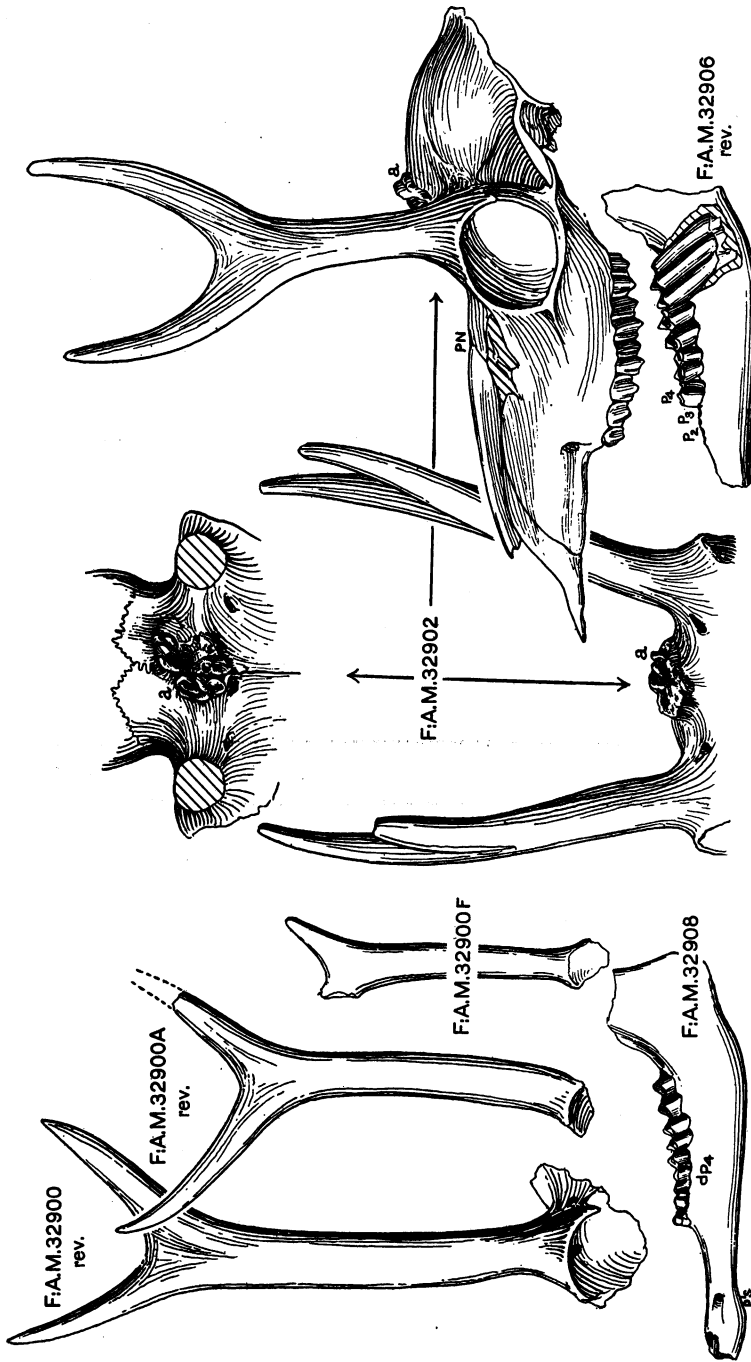


FIG. 37A. *Paracosoryx burgensis*, n.sp. (F.A.M. 32900, type, rev.), and *Cosoryx furcatus* Leidy, ref. (F.A.M. 32900A [rev.], 32900F [adolescent], 32908, 32902 [skull] and 32906 [rev.]), age and individual variation in horns from Burge Quarry, Cherry County, Nebraska.

Lateral views (and one dorsal and anterior) $\times 1$. a, median ossification; PN, posterior end nasal; PS, posterior border symphysis. (See also Fig. 2 [F.A.M. 32902] and pages 342, 343, 418.)

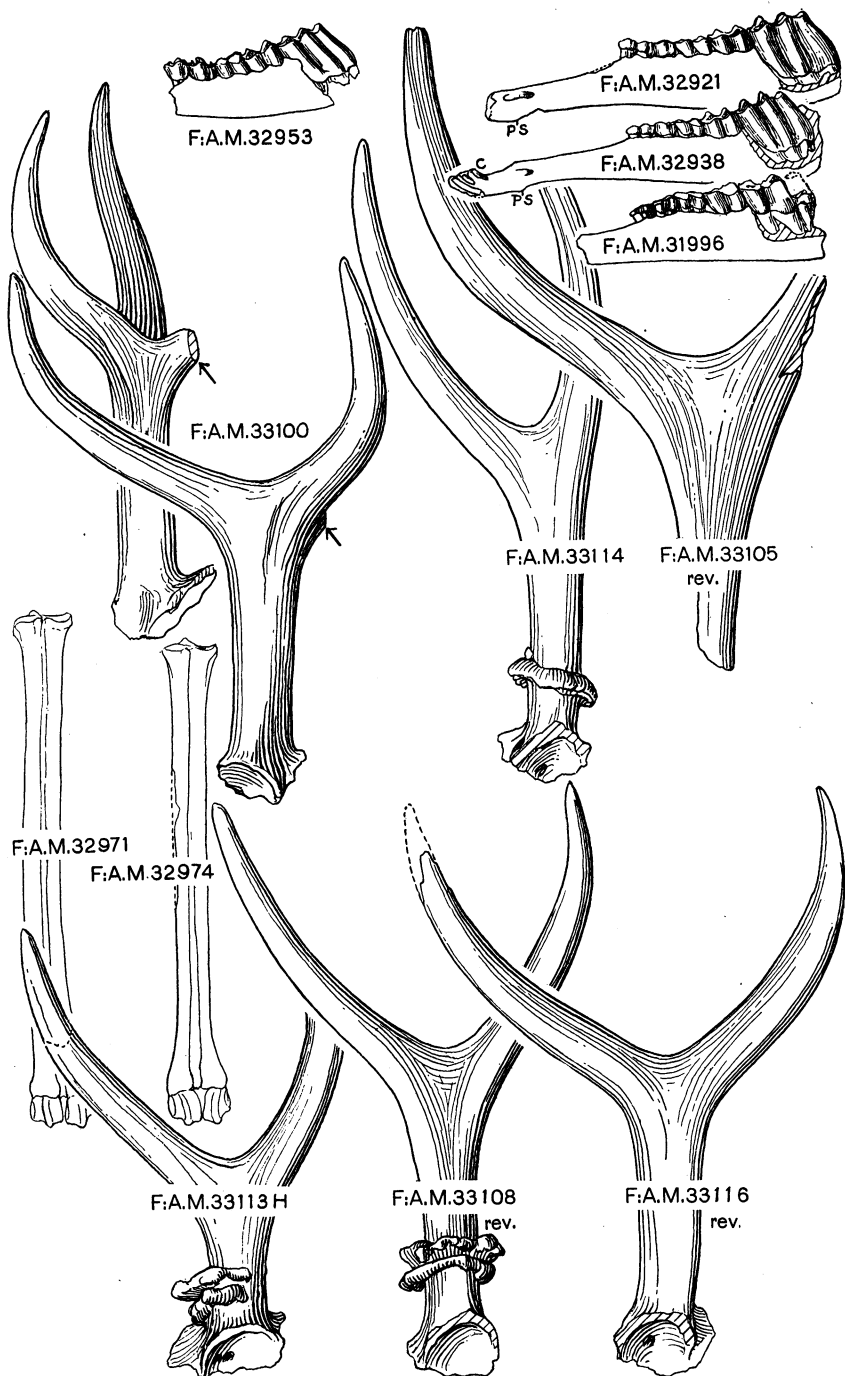


FIG. 38. *C. (Subcosoryx) cerroensis*, n.subg. and sp., ref., age and individual variation in horns (F:A.M.33114, 33105 [rev.], 33113H, 33108 [rev.] and 33116 [rev.]), mandibular rami (F:A.M.32921, 32938 and 31996) and metatarsi (F:A.M. 32971 and 32974); and *R. (Paramoceros) marthæ*, n.sp., (?)ref. (F:A.M.33100 and 32953), from Round Mountain Quarry, New Mexico.

Lateral views (and one posterior) $\times \frac{1}{2}$. PS, posterior border symphysis; arrow (F:A.M.33100), base of third prong. (See also Fig. 42 [F:A.M.31996] and pages 337-339, 393-394, 456; and 330, 403.)

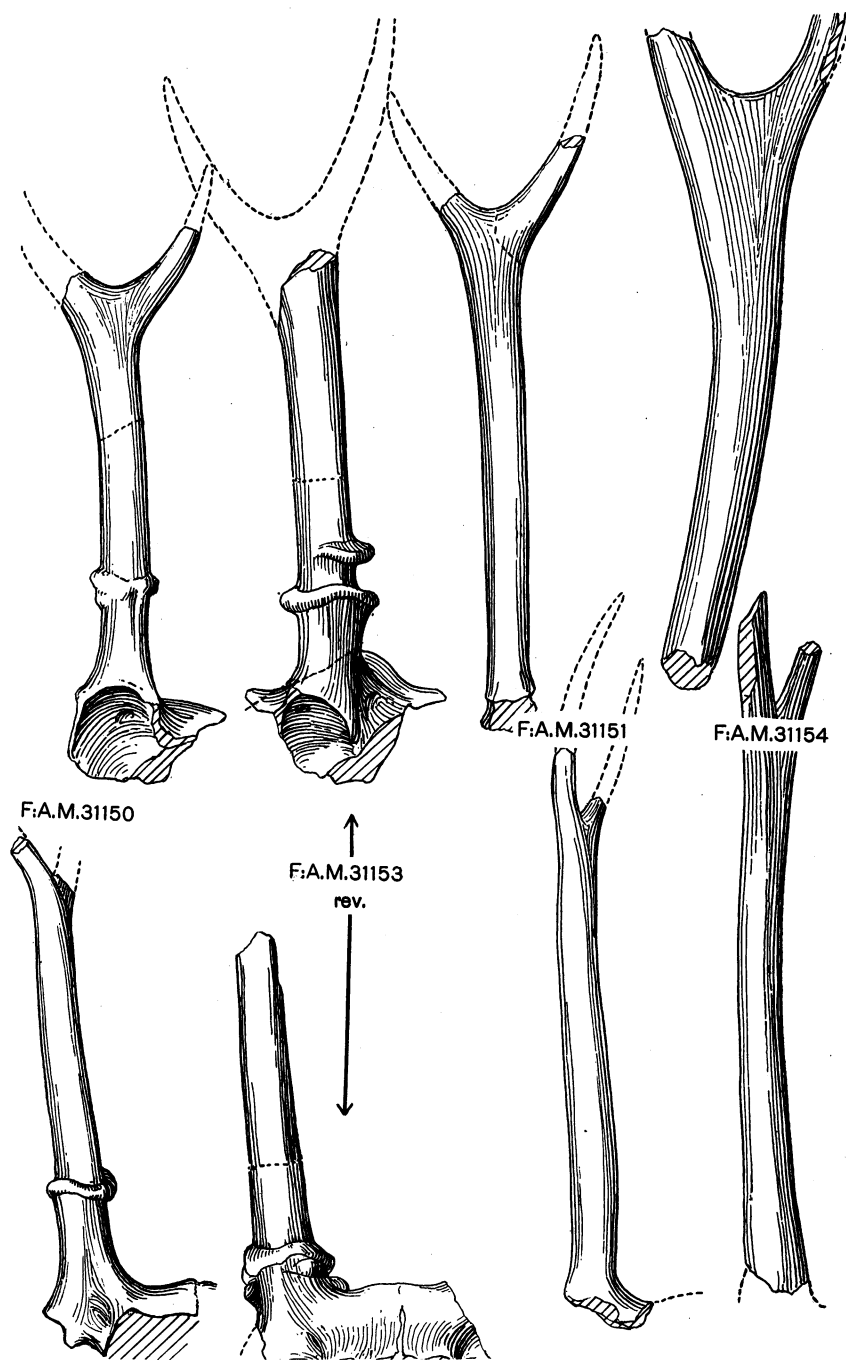


FIG. 38A. *C. (Paracosoryx) alticornis*, n.sp. (F:A.M.31150, 31153 [rev.], 31151 and 31154, type), individual and age variation in horns from Barstow, California. Lateral and posterior views $\times \frac{1}{2}$. (See page 347.)

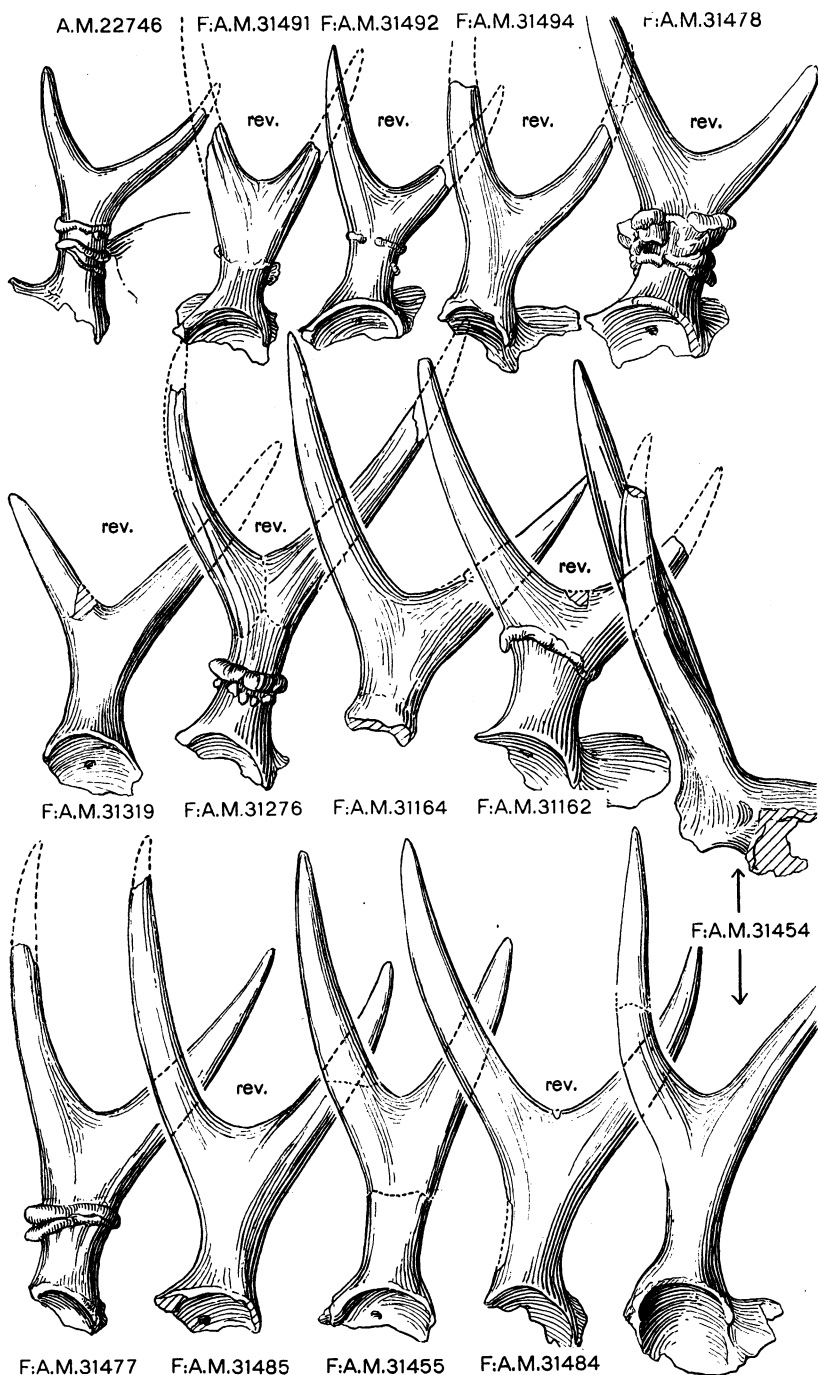


FIG. 39. *Meryceros*, n.g., and *Subparacosoryx*, n.subg., A.M.22746 only, comparison of horns from the Late Tertiary of Nebraska, New Mexico, Colorado and California. Lateral views (and one posterior) $\times \frac{1}{2}$. (See legend, page 313.)

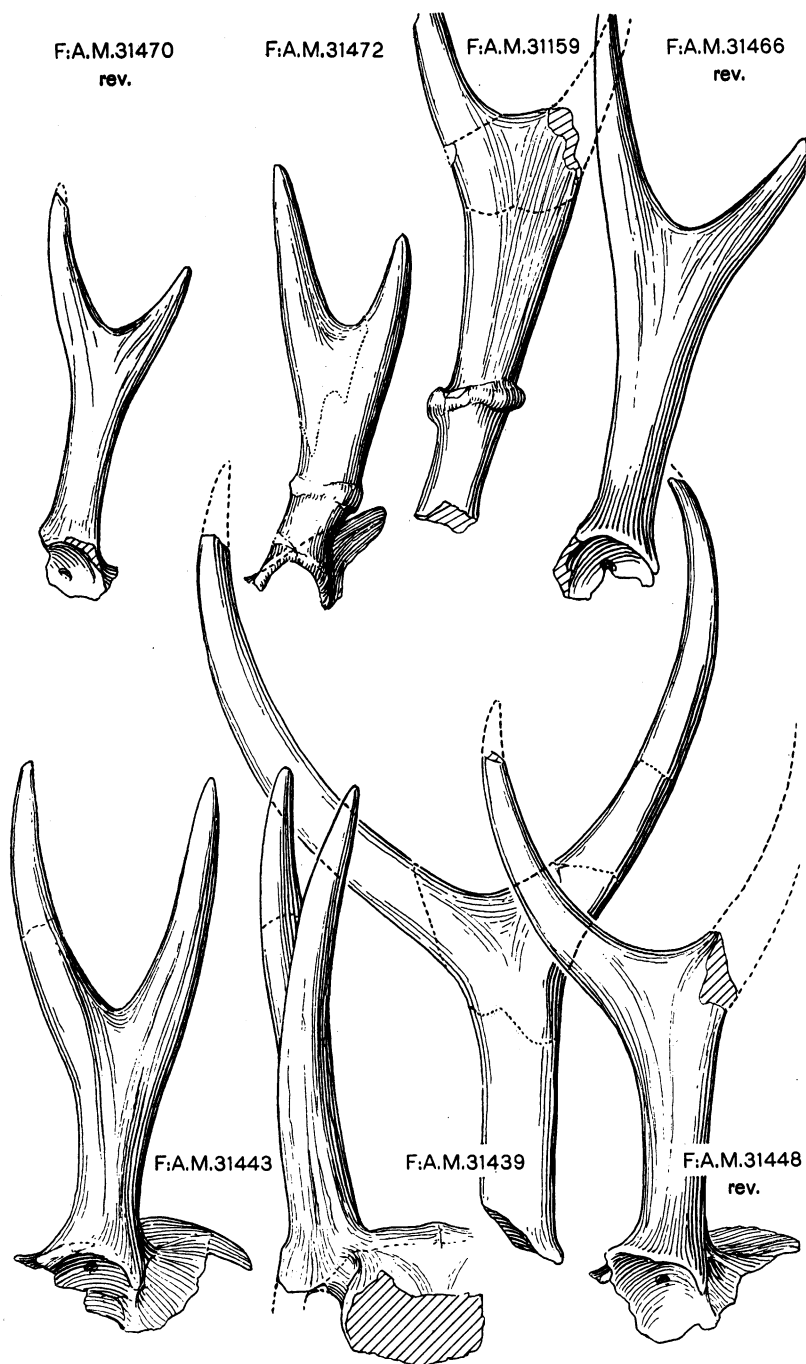


FIG. 39A. *Meryceros*, n.g., and *C. (Paracosoryx)*, n.subg., F.A.M.31159, comparison of horns from the Late Tertiary of New Mexico and California.
Lateral views (and one posterior) $\times \frac{1}{2}$. (See legend, page 313.)

Characters of Mandibles and Dentitions

(For General Discussion and Details, See Section III, Page 372)

The one thousand and ninety-five listed, and some two thousand mentioned mandibular and maxillary specimens which have been available for study are considered below, under Section III. The Merycodontine teeth, so far as observable, except for smaller size, are very like those of modern *Antilocapra*. The size overlap evidently existing between the smaller teeth of the larger Antilocapriini—see *Plioceros* and *Texoceros*, and the larger of the specimens included below under the Merycodontini—leaves such reference of the latter at times open to question.

FIG. 39. *Meryceros*, n.g., and *Subparacosoryx*, n.subg., comparison of horns from the Late Tertiary of Nebraska, New Mexico, Colorado and California.

Lateral views (and one posterior) $\times \frac{1}{2}$.

A.M.22746, *C. (Subparacosoryx) savaronis*, n.subg. and sp., ref., from Sioux County, Nebraska.

(See page 353.)

F:A.M.31491, 31492, 31494 and 31478, *Meryceros crucensis*, n.sp., ref., rev., from New Mexico.

(See page 358.)

F:A.M.31319, *Meryceros warreni*, var. or subsp., rev., from Pawnee Creek, Colorado.

(See page 367.)

F:A.M.31276, *Meryceros warreni johnsoni*, var., rev., from Fairfield Creek, Brown County, Nebraska.

(See page 366.)

F:A.M.31164 and 31162 (rev.), *Meryceros joraki*, n.sp., ref., from Barstow, California.

(See pages 368, 369.)

F:A.M.31477, 31485 (rev.), 31455, 31484 (rev.) and 31454, *Meryceros crucensis*, n.sp., ref., from New Mexico. (Lateral and posterior views of F:A.M.31454.)

(See pages 357, 358.)

FIG. 39A. *Meryceros*, n.g., and *C. (Paracosoryx)*, n.subg., comparison of horns from the Tertiary of New Mexico and California.

Lateral views (and one posterior) $\times \frac{1}{2}$.

F:A.M.31470 (rev., immature), 31472, 31466 (type, rev.) and 31443, *Meryceros crucensis*, n.sp., from New Mexico. (Lateral and posterior views of F:A.M.31443.)

(See pages 356, 357.)

F:A.M.31159, *C. (Paracosoryx) alticornis*, n.sp., ref., from Barstow, California.

(See page 347.)

F:A.M.31439 and 31448 (rev.), *Meryceros major*, n.sp., type and ref., from Santa Cruz, New Mexico.

(See page 355.)

The Merycodontine mandibles and detached rami exhibit certain differences in the elongation of the post-/C diastema, in the proportions of premolars relative to molars, in the height of the crowns and in actual size.

The ramal diastema is rarely preserved intact, and definite measurements are impossible in the case of worn teeth. With age and wear, through the anteroposterior shortening of the anterior teeth and the forward crowding and greater prominence of the diagonally advancing m_3 , the actual linear dimensions of the teeth of any one specimen are continually changing. A series of proportionate measurements have been taken of a certain number of more typical examples (see Table VIII, page 384). The data indicate that in the slightly worn specimens the anteroposterior diameter of the smallest m_3 (Size Group VII, F:A.M. 30991, 9.3 mm.) is approximately but 48% of the largest (Size Group II, F:A.M. 30925, 19.5 mm.), and the length from posterior border of symphysis to m_3 in the smallest ramus (Size Group VI, F:A.M. 31577, 16 mm.) approximates 53% of that of the largest (F:A.M. 30925, 30 mm.). More moderate variations are observed in a series of Recent *Antilocapra*: The anteroposterior diameter of the smallest m_3 (A.M. [M.] 5036, 18.5 mm.) is approximately 77% of the largest (A.M. [M.] 11095, 24.5 mm.), and the length from posterior border of symphysis to m_3 , inclusive, in the smallest ramus (A.M. [M.] 5036, 36 mm.) approximates 75% of the largest (A.M. [M.] 11095, 48 mm.).

The rôle of sex in connection with size and relative proportions of p_2 and the successive premolars is unknown. Intercolumnar styles tend to be the rule in the m_1 and styles occur at times in the posterior molars, being more prominent in aged specimens and more noticeable in the case of the Barstow remains than in those from other areas.

In addition to the difficult problems of the number and of the possible relationships of the forms represented by the large available series of variable horns and rami, there are perplexing questions as to which of these are represented by the type specimens of previously named species, when such types were ramal or partial ramal dentitions unassociated with horns.

As noted above, *Merycodus* Leidy, genotypic species *M. necatus* Leidy (1854), was founded on a ramal fragment from the Bijou Hills. The genotype was never figured and its present whereabouts¹ is un-

¹ The statement of Matthew (1918, p. 219) that the type is in the American Museum collection appears to be incorrect as the specimen has never been entered in the Museum catalogue.

known. Pending the securing of a definite neotype from the type locality, the species and genus remain indeterminate. Leidy's measurements of the p_4-m_1 indicate a relatively large size. *Cosoryx* Leidy, as elsewhere observed (see page 292), may prove to be synonymous with the former genus.

Paracosoryx sabulonis (Matthew and Cook), 1909, from Sioux County, Nebraska, type, slender ramus with short diastema, as discussed above, may supplant *Subparacosoryx savaronis*, n.subg. and sp., based on a small cranium from the same general area. The actual affinity is yet to be determined in:

M. tehuanus (Cope), 1877, from New Mexico, type representing an immature individual [*Dicrocerus tehuanus* Cope, 1877; ??*Merycodus tehuanus* (Cope) Matthew, 1909]; and

M. grandis Hay, 1924, from Texas, based on worn and broken horn fragments,

M. (?)agilis Douglass, 1899, from western Montana, based on a female skull, and

(?)*C. (Paracosoryx) nevadensis* (Merriam) [*Merycodus nevadensis* Merriam, 1911], from High Rock Canyon, Nevada, and

(?)*C. (Paracosoryx)* species (Gazin), 1932, from Malheur County, Oregon, based on mandibular fragments, must await more definite determination.

M. altidens Matthew, 1924, type A.M.18981, right ramal fragment with m_3 , from Upper Snake Creek, is questionably transferred to (?)*Texoceros*.

The large *Dicrocerus teres* Cope is allocated to *Cranioceras*.

Dicrocerus trilateralis Cope, in the ramal fragment at least, is probably of the Camelidæ.

More recently the available data as to the mandibular characters in *Cosoryx* and *Meryceros* have been largely increased through receipt of the several fine series of crania, rami and limb elements from the Midway, Nenzel and Crookston Bridge Quarries that include certain associated skulls and mandibles. The variations observed in these specimens are touched on in Section III, page 372.

As noted above, the eight hundred and thirty-nine specimens of lower dentitions in the following section of the report are listed under six size groups which parallel Size Groups II–VII of the Blastomerycini and are tentatively allocated on the basis of the post-diastema length and the size of the molars (see page 372). Examples of more outstanding variants are figured, Figs. 41–47A and (in part) 28B, 35A, 37, 37A, 38. Incidentally, certain examples of upper dentitions are shown in plates of horns and crania, Figs. 26, 28A–C, 37, 37A, 40 (in part).

Characters of Limbs

(For General Discussion and Details, See Section IV, Page 447)

The limb elements, mainly detached, exhibit a range in length fully compatible with the size range shown by the mandibles and teeth. Examples of the actual dimensions and proportions are given in the tables, and in certain cases specimens allocated to the group are figured, Figs. 25B, 38, 48 (in part). The only two Merycodontine-like metacarpals exhibiting rudiments of the lateral phalanges heretofore known to the writer are the Colorado specimen, A.M.9475, originally referred to *R. (M.) osborni*¹ and now transferred to (?) *Cosoryx furcatus*, and the New Mexican specimen here allocated to (?) *Longirostromeryx blicki*, n.sp. (F:A.M.31729). The actual condition of the manus and pes in most of the genera and subgenera, as the observations of authors thereon, yet remains in doubt.

William D. Matthew (1904, p. 105) wrote, "... Lateral toes on both fore and hind feet represented by tiny vestiges of the three phalanges..." (1924, p. 206) "The extreme reduction of the lateral digits, greater than among Cervidæ and less than in *Antilocapra* or most true antelopes...; while the grooved back of the metapodials... was quite obviously a primitive character, both in theory and from the record, and is shown by all Miocene ruminants of any group at all, and retained by some antelopes as well as by most deer."

E. L. Furlong (1927, p. 175) observes that the sum of Antilocaprid characters in the limbs of Merycodonts "... leads inevitably to the conclusion that the major part of the structures reflect the skeletal attributes of the Antilocapridæ... The cervid characters present in the merycodonts are many of them common to all artiodactyls." (The atlas and axis are fashioned as in *Antilocapra* versus deer.)

The definite retention of both lateral splints and phalanges in the manus of *Paracosoryx wilsoni* of Long Quarry, Sioux County, Nebraska, is attested through the discovery of a largely complete skeleton of an immature individual at the close of the 1936 field season by the J. Wilson party. The metacarpal length of this specimen is but 76% of a mature specimen from the same beds (Fig. 25B). The specimen includes the mandible, portions of a crushed skull with $dp_2^2-m_1^1$, and all of the limb elements with the exception of the distal one-half of the right tibia, the lateral splints of the left manus, and portions of vertebræ and ribs. The right manus retains both rudimentary splints and phalanges. Evidence is lacking as to the possible similar retention of lateral splints or phalanges in the pes. (Fig. 48A.)

¹ *R. (Merycodus) osborni*, type, skeleton, lateral phalanges of manus and pes restored in plaster.

Summary of Species and Subspecies

The forty-seven below-enumerated species, subspecies and varieties (thirty-eight named) are principally of interest as records of geological and geographical occurrences. Of the forty-seven, thirty-eight rest on evidence of the horns and nine on evidence of the mandible. The synonyms and list of types and referred remains are detailed on the following pages. The available horn specimens number five hundred and thirty-two, maxillary and mandibular specimens three thousand two hundred and nine, and limb specimens five hundred and fifty-three. (See Distribution Table VII, pages 268-269.)

The horn characters of the nine here recognized genera and subgenera have been discussed on preceding pages (p. 290).

SUBFAMILY 1.—RAMOCEROTINÆ

I. *Ramoceros*, new genus.

- (1) *Ramoceros ramosus* (Cope), 1874, from New Mexico.

TYPE (revised).—Three-pronged "antler," N.M.1144. Figured by Cope, 1877, Pl. LXXX, Figs. 1 and 2.

- (2) *Ramoceros ramosus quadratus*, n.subsp., from New Mexico.

TYPE.—Left horn, F:A.M.31581. This paper, *Figs. 31, 32*.

- (3) *Ramoceros osborni* (Matthew), genotypic species, from Pawnee Creek, Colorado.

GENOTYPE.—Partial skull, ramus and skeletal elements, A.M.9476. This paper, *Figs. 28, 28A* (skull), *43* (ramus).

- (4) *Ramoceros hitchcockensis*, n.sp., from Hitchcock County (and referred from Brown County), Nebraska.

TYPE.—Left horn-core, N.S.M.1-26-8-30.

IA. *Paramoceros*, new subgenus.

- (5) *R. (Paramoceros) marthæ*, n.sp., from New Mexico.

TYPE.—Left horn on cranial fragment, F:A.M.31620. This paper, *Figs. 33, 34*.

- (6) *R. (Paramoceros) howardæ*, n.sp., from Dutch Creek, Brown County, and (?) var., from Crookston Bridge, Cherry County, Nebraska.

TYPE.—Top of cranium with horns, F:A.M.31271. This paper, *Figs. 33, 34*.

- (7) *R. (Paramoceros) kansanus*, n.sp., from Kansas.

TYPE.—Left horn, F:A.M.31510.

- (8) *R. (Paramoceros) palmatus*, n.sp., from New Mexico.

TYPE.—Left horn, F:A.M.31580. This paper, *Figs. 33, 34*.

- (9) *R. (Paramoceros) brevicornis*, n.subg. and sp., from Barstow, California.

SUBGENOTYPE.—Frontal saddle with horns, F:A.M.31348. This paper, *Fig. 35*.

IB. *Merriamoceros*, new subgenus.

- (10) *R. (Merriamoceros) coronatus* (Merriam), subgenotypic and only known species, from Barstow, California.

SUBGENOTYPE.—Partial horn-core, U.C.20052.

SUBFAMILY 2.—COSORYCINÆ

II. *Cosoryx* Leidy (and IIA. *Subcosoryx*, new subgenus).

- (1) *C. (Subcosoryx) cerroensis*, n.subg. and sp., from New Mexico.

SUBGENOTYPE.—Left ramus, F:A.M.32978. This paper, *Fig. 42*. (See Dentition Section III, page 392.)

- (2) *Cosoryx ilfonsensis*, n.sp., from New Mexico.

TYPE.—Top of cranium and horns, F:A.M.31435. This paper, *Figs. 36, 36A*.

- (3) *Cosoryx furcatus* Leidy, genotypic species, from the Niobrara; and referred remains from Cherry, Brown and Hitchcock Counties, Nebraska.

GENOTYPE.—Partial horn-core, N.M.148 [A.M.9994, cast]. (Small.)

- (4) *Cosoryx furcatus sternbergi*, n.subsp., from Kansas.

TYPE.—Top of cranium with horns, and associated left ramus, F:A.M.31511. This paper, *Figs. 23, 28A, 36, 36A* (cranium and horns), *43* (ramus).

- (5) *Cosoryx furcatus*, var. or subsp., from Little White River, South Dakota.

EXAMPLE.—Horn on frontal fragment, A.M.10966.

[(5a) *Merycodus necatus* Leidy, from the same area, indet.]
(Genotype lost and never figured.)

- (6) *Cosoryx furcatus mooki*, n.subsp., from Montana.

TYPE.—Partial cranium with horns, and associated ramal fragment, A.M.21370. This paper, *Fig. 38A*.

- (6a) (?) *Cosoryx agilis* Douglass, from Madison Valley beds, Montana.

TYPE.—Immature partial skull, mandible and skeletal elements, C.M. 703.

- (6b) (?) *Cosoryx* var., from the Yellowstone River, vicinity of Gardiner, Montana.

EXAMPLE.—Left immature ramus, Marshall Collection No. 2.

- (7) *Cosoryx furcatus*, var. or subsp., from Colorado.

EXAMPLE.—Portion of horn and ?associated right maxilla, A.M.22710.

IIB. *Paracosoryx*,¹ new subgenus (and IIC. *Subparacosoryx*, new subgenus).

- (8) *C. (Paracosoryx) alticornis*, n.sp., from Barstow, California.

TYPE.—Elongate horn-core, F.A.M.31154. This paper, *Fig. 38A*.

- (8a) (?) Var. or *Cosoryx* species, from Barstow, California.

EXAMPLE.—Left horn on cranial fragment, F.A.M.31175.

- (9) *C. (Paracosoryx) furlongi*, n.sp., from the Ricardo Pliocene, California.

TYPE.—Partial cranium, maxillary series, ramus, etc., U.C.26795.

- (10) *C. (Paracosoryx)* species, from the Tejon Hills, California.

EXAMPLE.—Partial antler, U.C.22332.

- (11) *C. (Paracosoryx) loxocerus* (Furlong), from vicinity of Tonopah, Nevada.

TYPE.—Right ramus, C.I.T.1301.

¹ See *Paracosoryx burgensis*, n.sp., page 343.

- (11a) (?) *C. (Paracosoryx) nevadensis* (Merriam), from High Rock Canyon, Nevada.

TYPE.—Left ramal fragment, U.C.12608.

- (11b) *C. (Paracosoryx)* var., from Virgin Valley, Nevada.

EXAMPLE.—Slender antler, U.C.11319.

- (12) (?) *C. (Paracosoryx)* species (Gazin), from Skull Spring, Oregon.

EXAMPLE.—Right fragment of immature ramus, C.I.T.383.

- (13) *C. (Paracosoryx) wilsoni*, n.subg. and sp., from Sioux County, Nebraska.

SUBGENOTYPE.—Partial cranium, F:A.M.32470. This paper, *Fig. 37*.

- (14) *C. (Subparacosoryx) savaronis*, n.subg. and sp., from Sioux County, Nebraska.

SUBGENOTYPE.—Small partial cranium with horns, A.M.17339. This paper, *Figs. 28, 28A*.

- (14a) *C. (Paracosoryx) sabulonis* (Matthew and Cook), from Sioux County, Nebraska.

TYPE.—Right ramus, A.M.14109. This paper, *Fig. 44*.

- (15) *C. (Paracosoryx) dawesensis*, n.sp., from Dawes County, Nebraska.

TYPE.—Left horn-core, F:B:A.M.32856. This paper, *Fig. 37*.

- (16) *C. (Paracosoryx)* species, from Sheridan County, Nebraska.

EXAMPLE.—Frontlet with left horn-core, N.S.M.9-1-8-33.

III. *Meryceros*, new genus.

The horns of each of the following species, where well represented, tend to exhibit two main variations, including (a) typically compressed-wedge-shafted, and (b) less tall, more waisted and wider branching "*M. warreni*"-like vars.

- (1) *Meryceros major*, n.sp., from New Mexico.

TYPE.—Left horn, F:A.M.31439 (of unusual size). This paper, *Fig. 39A*.

- (2) *Meryceros cruceensis*, n.sp., from New Mexico.

TYPE.—Right horn on cranial fragment, F:A.M.31466. This paper, *Fig. 39A*.

- (3) *Meryceros nenzelensis*, n.sp., from Nenzel, Cherry County, Nebraska.

TYPE.—Partial skull with heavy, branching horn, F:A.M.32174.
This paper, *Fig. 40*.

- (4) *Meryceros warreni* (Leidy), 1858, genotypic species, from the Niobrara, Nebraska.

GENOTYPE.—Right horn-core on cranial fragment, N.M.149 [A.M. 15596, cast].

- (4a) *Meryceros warreni johnsoni*, n.subsp., from Crookston Bridge, Cherry County, Nebraska.

TYPE.—Skull with premaxillæ and mandible, N.S.M.2-3-8-34. This paper, *Figs. 28B, 28C*.

Including local vars. from Cherry and Brown Counties, Nebraska.

- (4b) *Meryceros warreni*, var., from Dawes County, Nebraska.

EXAMPLE.—Right horn-core, F:B:A.M.31393.

- (5) *Meryceros warreni*, var. or subspecies, from Pawnee Creek, Colorado.

EXAMPLE.—Both horns, F:A.M.31319. This paper, *Fig. 39*.

- (6) *Meryceros joraki*, n.sp., from Barstow, California.

TYPE.—Major portion of cranium, F:A.M.31163. This paper, *Figs. 28, 28A*.

- (7) *Meryceros hookwayi* (Furlong), from vicinity of Tonopah, Nevada.

TYPE.—Right ramus, C.I.T.1257.

IIIA. *Submeryceros*, new subgenus.

- (8) *M. (Submeryceros) crucianus*, n.subg. and sp., from Santa Cruz, New Mexico.

SUBGENOTYPE.—Left horn, F:A.M.31495. This paper, *Fig. 35*.

For convenience, several small species and subspecies, known alone by mandibular rami, are questionably referred to this subgenus:

- (9) (?) *Submeryceros minor*, n.sp., from New Mexico. (Size Group VI.)

TYPE.—Left ramal fragment, F:A.M.30988. This paper, *Fig. 41*.

- (9a) (?) *Submeryceros minor serpentinus*, n.subsp., from Snake Creek, Sioux County, Nebraska.

TYPE.—Right ramus, F:A.M.31577. This paper, *Fig. 44*.

- (9b) (?) *Submeryceros minor pawniensis*, n.subsp., from Pawnee Creek, Colorado.

TYPE.—Partial left ramus, F:A.M.31643. This paper, *Fig. 43*.

- (10) (?) *Submeryceros minimus*, n.sp., from New Mexico. (Size Group VII.)

TYPE.—Right ramal fragment, F:A.M.30991. This paper, *Fig. 41*.

"Fossil species," as frequently used (footnote 2, page 30), tends to become a synonym of occurrence. In the Merycodontini, observed differences of form are largely restricted to the nine recognized genera and subgenera. (See discussion, on previous pages, of the characters which distinguish these from one another.) With advancing knowledge of the kinds of extinct mammals and their distribution in geologic time, the present and ever more cumbersome-becoming system of binomial nomenclature under which the fossil "species" is designated by name may be supplanted, in part, by some such system of key numbers (or letters) as used in the distribution tables of this report.

Hypothetically, primitive *Subparacosoryx* and *Paracosoryx*-like horncores may have given rise to the horns of *Cosoryx* and to the three-tined antler of *Paramoceros* and *Ramoceros*. A short-shafted *Ramoceros* predecessor may have been ancestral to *Merriamoceros*. Among the heavier-proportioned of the *Cosoryx*-like horns—the more elongate are separable from *Paracosoryx* mainly through the position of the burr; the less elongate grade into the least squat of the horns grouped under *Meryceros*. Separately burred prongs, as seen in *Submeryceros*, may have preceded the burred shafts of both *Subparacosoryx* and *Meryceros*.

The detailed listing of the above forty-seven species, subspecies and varieties, thirty-eight based on the occurrence of horns and nine of mandibular specimens, their types and synonymy, and a catalogue of the specimens referred to each, arranged according to genera and localities, follows.

SECTION II.—MERYCODONTINI "HORNS"

Frontispiece, A; Figures 27-40 and (in part) 2, 26

Genera, Subgenera and Species; Synonymy, Types and Referred Horns

I. **RAMOCEROS**, NEW GENUS

Reconstruction, Figure 27E

The genus is erected to include those heretofore rarely represented forms bearing Cervine-like horns with three to four points. It is typified by *R. ramosus* (Cope) from New Mexico and *R. osborni* (Matthew) from Colorado, selected as the genotypic species. (See *Ramocerotinæ*, page 290.)

(1) **Ramoceros ramosus** (Cope), 1874

From the Santa Fé Marls, New Mexico

The three-pronged "antler" figured by Cope (1877, Plate LXXX, Figures 1 and 2), under "*Dicrocerus furcatus*," is considered as the type. It would seem probable that this is the same horn which Cope (1874) originally described under *Cosoryx ramosus*. Cope (1874, p. 149): "This species is larger than the *C. furcatus*, Leidy, and exhibits two antlers instead of one, of which the first is given off at a point much further from the base than in that species. . . . Mandibles with teeth of two species of this genus were found. . . . The larger differs in the elevation of the interrescentic column of the first molar . . . this may however be but an individual variation. The diastema is long, and the ramus of that point quite slender." Cope (1877, legend for Fig. 5, Pl. LXXXII) cites a partial mandibular ramus (N.M.5390) as the type of *D. ramosus*, which at this time he transfers to *Dicrocerus necatus* Leidy, referred.

[The remaining specimens on Plate LXXX seem representative of the *R. (Paramoceros) marthæ* form in which the secondary shaft is greatly reduced to absent.]

Cosoryx ramosus COPE, 1874, Proc. Acad. Nat. Sci. Phila., XXVI, p. 148; Ann. Rept. Chief of Engineers, II, Pt. II, Extract from Appendix FF, p. 128; 1889, Amer. Nat., XXIII, p. 128, Fig. 18 (3 and 4).

Dicrocerus furcatus LEIDY, referred COPE, 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, p. 350, Pls. LXXX, Figs. 1 and 2; LXXXII, Fig. 1 (writer questions reference of ramus). 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, p. 32.

TYPE.—Three-pronged "antler." N.M.1144

Figured by Cope, 1877, Pl. LXXX, Figs. 1 and 2.

REFERRED (collected by Joseph Rak and associates).—

New specimens, F:A.M. Collection. See lists and figures (Figs. 29, 30, and [in part] 28, 28A):

Five large-moderate-sized horn-cores:

Right horn on cranial fragment, 1st and 2d points, tips broken, 3d missing. Burr.	F:A.M.31588	From Santa Cruz, 1st wash, 1928. This paper, <i>Figs. 29, 30.</i>
Right horn, 1st point broken, 2d and 3d points complete, base missing.	F:A.M.31589	1928.
Left horn, 1st point tip broken, 2d and 3d points complete, base missing.	F:A.M.31590	From Santa Cruz, red layer, 1930. This paper, <i>Figs. 29, 30.</i>
Left portion of horn (larger), 1st and 3d points missing.	F:A.M.31591	From Santa Cruz, 1st wash, 1928.
Top of cranium and unsymmetrical, burred horns (left shorter, with three points, right longer-shafted, with 2d and 3d points missing).	F:A.M.31592	From Lower Pojuaque Bluffs, 1929. This paper, <i>Figs. 28, 28A, 29, 30.</i>

(See associated ramus, maxilla and limbs, Dentition Section III, page 399; Limb Section IV, page 453. Limbs, this paper, *Figs. 25B, 48.*)

Three fragmental horn-cores from Santa Cruz:

Left horn, points broken.	F:A.M.31593	From red layer, 1927.
Right horn, 1st point complete, 2d and 3d points broken.	F:A.M.31594	1927.
Left horn, 1st point tip broken, 2d and 3d points missing.	F:A.M.31595	1926.

Two moderate-sized specimens:

Right horn, three points complete, with burr.	F:A.M.31596	
Right horn on cranial fragment, 1st and 3d points missing, 2d point broken near tip. No burr.	F:A.M.31597	From Ojo Caliente, 1925.

Six fragments:

Distal portion of left horn, 1st point missing, 2d and 3d points complete; and ?associated left maxillary fragment with m ¹ -m ² .	F:A.M.31628	Between old and new Santa Fé roads, 1926.
Right horn on cranial fragment, 1st point broken, 2d and 3d points missing, no burr.	F:A.M.31599	From Santa Fé area, 1925.
Left shaft with burr, points missing.	F:A.M.31600	Under Pojuaque Bluffs, 1926.
Fragment.	F:A.M.31601A	From W. side of N. Pojuaque Bluffs, 1928.
Fragment.	F:A.M.31601B	From Ojo Caliente, red, 1926.
Distal fork.	F:A.M.31629	From Santa Cruz, 1st wash, 1928.

Twenty-two small-sized specimens:

Right horn on cranial fragment, 1st and 2d point tips broken, 3d point missing; with burr.	F:A.M.31603	From Santa Cruz.
Left horn on cranial fragment, points broken, with burr.	F:A.M.31604	From Santa Fé area, 1927.
Right horn on cranial fragment, 1st point complete, 2d and 3d points missing; with burr.	F:A.M.31605	From Santa Fé area, 1927.
Right horn on cranial fragment, points broken, burr remnant.	F:A.M.31606	From Santa Cruz, 1927.
Right horn on cranial fragment, points missing, ?trace of burr.	F:A.M.31607	1925.
Distal portion of right horn, point tips broken.	F:A.M.31608	From Santa Cruz, red layer, between 1st and 2d washes, 1930.
Left horn, 1st point tip broken, 2d and 3d points missing, no burr.	F:A.M.31609	From Skull Ridge, 1927.

Left horn, 1st point missing, 2d and 3d point tips broken, no burr.	F:A.M.31610	From Santa Cruz, upper red layer, 1st wash, 1928.
Left horn, 1st point complete, 2d and 3d points missing, no burr.	F:A.M.31611	From Santa Cruz, 1st wash, 1928.
Left horn on cranial fragment, 1st point tip broken, 2d point complete, 3d point broken, burr remnant.	F:A.M.31612	From Ojo Caliente, 1925.
Left horn on cranial fragment, 1st point tip broken, 2d and 3d points missing, no burr.	F:A.M.31613	From Santa Cruz, 1925.
Left horn on cranial fragment, 1st point broken, 2d and 3d points missing, with burr.	F:A.M.31614A	From Santa Cruz, 1925.
Fragment of horn, points broken.	F:A.M.31614B	From Santa Cruz.
Fragment of horn, points broken.	F:A.M.31614C	
Left horn, 1st and 2d points broken near tips, 3d point missing, no burr.	F:A.M.31615	1928.
Right shaft on cranial fragment, points broken, no burr; and etc. fragments.	F:A.M.31616A	From Santa Cruz, upper red layer, 1st wash, 1928.
Portion of right shaft on cranial fragment, points missing, burr remnant; and etc. fragments.	F:A.M.31616B	From Santa Cruz, 1927.
Two fragments of horns.	F:A.M.31616C, D	From Santa Fé area, 1927.
Right horn on cranial fragment, 1st and 2d points missing, 3d point tip broken, no burr.	F:A.M.31627	From Santa Cruz.
Right horn on cranial fragment, 1st and 2d point tips broken, 3d point missing, with burr.	F:A.M.31617	1925. This paper, <i>Figs. 29, 30.</i>
1st point depressed.		

Right horn on cranial fragment, 1st and 2d points broken, 3d point complete, with heavy burr.	F:A.M.31618	From Santa Cruz, 1930. This paper, <i>Figs. 29, 30.</i>
Peculiar.		

[Additional specimens (not included in the count), secured by the John C. Blick party from West Pojuaque Bluffs in the 1936 season, include: F:A.M.

Portions of extremely large horn (resembling <i>Paramoceros</i> , but heavier)	31632
Left partial horn (approximating <i>Paramoceros</i> , F:A.M.31619).....	31630A
Two left horns, points broken (resembling <i>Ramoceros</i> , F:A.M.31592)...	31631,
	31630
Right horn, tips broken (resembling <i>Ramoceros</i> , F:A.M.31603).....	31631A
Right horn, tip broken (approximating smallest of the <i>Ramoceros</i> specimens).....	31474]

(2) *Ramoceros ramosus quadratus*, new subspecies

From New Mexico

TYPE.—Left horn, 1st point forked, tips broken, 2d and 3d points broken.	F:A.M.31581	Santa Cruz, red layer, 1927. Collected by Joseph Rak. This paper, <i>Figs. 31, 32.</i>
Size large. (Proximal shaft missing thus leaving no evidence regarding burr.)		

REFERRED.—

Left horn, 1st point forked, 2d and 3d points and proximal end of shaft missing.	F:A.M.31582	From Santa Cruz, 1st wash, upper layer, 1928.
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Two moderate-sized specimens:

Left horn on cranial fragment, points missing. 1st point forking not shown, burr indicated.	F:A.M.31583	From Santa Cruz.
Left horn, 1st point forked; tips broken, proximal end of shaft missing.	F:A.M.31584	1928. This paper, <i>Figs. 31, 32.</i>

One large-sized specimen with burr remnant, upper beam very much reduced:

Left horn on cranial fragment, 1st point missing, 2d and 3d points complete, burr remnant.	F:A.M.31602	From N. Pojuaque Bluffs, 1933.
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One moderate-sized specimen:

Left horn, 1st point complete and with incipient fork, 2d broken, 3d missing. With burr.	F:A.M.31598	From Santa Cruz, 1st wash, 1928.
"Brow" tine reveals incipient forking.		This paper, <i>Figs. 31, 32.</i>

EXACT REFERENCE QUESTIONED.—

Three broken shafts:

Left shaft on cranial fragment, points missing. Burr indicated.	F:A.M.31585	From Santa Cruz, 1926.
Horn-core, points missing, no burr.	F:A.M.31586	From Santa Cruz, 1927.
Horn-core, points missing, tendency toward burr.	F:A.M.31587	Under Pojuaque Bluffs, 1926.

Lower portions of five shafts, with burrs, on cranial fragments:

Right and left.	F:A.M.31623, A	From Santa Fé area, 1924.
Right.	F:A.M.31623C	From Santa Fé area, 1925.
Right.	F:A.M.31623B	From Third District.
Fragment (burr heavy).	F:A.M.31623D	From Santa Cruz, 1930.

(3) *Ramoceros osborni* (Matthew), genotypic species

From Pawnee Creek, Colorado

Merycodus osborni MATTHEW, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 107, Pl. III and Text-Figs. 1-3, 9-13, 15; 1909, Bull. No. 361, U. S. Geol. Surv., p. 115.

GENOTYPE.—Partial skull, ramus and skeletal elements.	A.M.9476	From Cedar Creek, 1901. Figured by Matthew, 1904, Pl. III and Text-Figs. 1-3 (skull and ramus), 9-13, 15 (skeletal elements); this paper, <i>Figs. 28, 28A</i> (skull), <i>43</i> (ramus).
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(See Dentition Section III, page 406, and Limb Section IV, page 454.)

While the ramus (A.M.9475), heretofore considered part of "cotype" and figured by Matthew (1904, Fig. 8), is suggestive of the type, the horns, maxilla and limbs (A.M.9475) may have belonged to different individuals. The horns are of *C. furcatus* and not of *R. osborni* form.

(4) *Ramoceros hitchcockensis*, new species

From Nebraska

TYPE.—Left three-pointed N.S.M.1-26-8-30 From first canyon west of
antler-like horn-core. Burroak Creek (a side
branch of Driftwood
Creek), Hitchcock County.

REFERRED.—

Base of right core, with A.M.8509 Hazard Collection.
burr. From (?) southern Nebraska.

TENTATIVELY REFERRED.—

Mature horn-core, broken F:A.M.31180 From Fairfield Creek, Brown
off above burr. County.

IA. *PARAMOCEROS*, NEW SUBGENUS

Reconstructions, Figure 27c, d

(5) *R. (Paramoceros) marthæ*, new species

From New Mexico

Dicrocerus furcatus LEIDY, referred COPE, 1877, Rept. U. S. Geog. Surv. W. 100th
Merid. (Wheeler), IV, Pt. II, p. 350, Pl. LXXX, Figs. 3, 4 and 6. 1907, Bull.
U. S. Nat. Mus., No. 53, Pt. II, p. 32.

TYPE.—Left horn on cranial F:A.M.31620 From Santa Cruz, upper
fragment, points missing, no layer, 1928.
burr. Collected by Joseph Rak.
Slender shaft. Size large. This paper, Figs. 33, 34.

REFERRED.—

Fragments from the Santa Fé marls figured by Cope, 1877, Pl. LXXX, Figs. 3, 4 and
6, doubtfully referred here.

Three large-sized specimens from Santa Cruz:

Right horn on cranial frag- F:A.M.31621 1925.
ment, 1st point broken,
2d and 3d points missing,
no burr.

Right horn on cranial fragment, points missing, with burr, and ?associated calcaneum; and fragment of horn.	F:A.M.31622 and A	From 1st wash, 1933.
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Specimen from Pojuaque Bluffs:

Right horn, tips broken.	F:A.M.31622B	1935.
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Five small-sized specimens (possibly distinct species):

Two from North Pojuaque Bluffs:

Right horn on cranial fragment, points complete, trace of burr.	F:A.M.31619	1933. This paper, <i>Figs. 33, 34.</i>
Left horn on cranial fragment, no burr, 1st point complete, 2d and 3d points missing.	F:A.M.31625	From west side, 1928.

Three from Santa Cruz:

Right horn on cranial fragment and burr, 1st point complete, 2d point missing, 3d point tip broken.	F:A.M.31624	1925. This paper, <i>Figs. 33, 34.</i>
Left horn, 1st and 2d points missing, 3d point tip broken, no burr.	F:A.M.31626	
Fragment of horn.	F:A.M.31626A	1928.

Doubtfully referred specimen from Round Mountain Quarry, collected in November, 1935 [possibly of an aberrant individual of *C. (Subcosoryx) cerroensis*]:

Left horn-core on cranial fragment, posterior inner point broken.	F:A.M.33100	This paper, <i>Fig. 38.</i>
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(6) **R. (Paramoceros) howardæ**, new species

From Dutch Creek, Brown County, Nebraska

TYPE.—Top of cranium with horns (points missing, burrs heavy) and m^1 - m^2 . (w++)	F:A.M.31271	Collected by Morris F. Skinner, 1929. This paper, <i>Figs. 33, 34.</i>
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Size moderate. (See Dentition Section III, page 413.)

(?)Var.

From Crookston Bridge Quarry, Cherry County, Nebraska

EXAMPLE.—Basal portion of N.S.M.6-19-9-34
horn.

(Not cited in Distribution Table VII; not included in specimen count.)

(7) *R. (Paramoceros) kansanus*, new species

From Kansas

TYPE.—Left horn with small posterior point, anterior points missing, no burr; and ?associated astragalus and phalanx.

F:A.M.31510

From M. F. Frake's ranch, 16 miles S.E. of Trenton, Nebraska, 1933.

(See referred mandible, Dentition Section III, page 410; and limbs, Limb Section IV, page 455.)

(8) *R. (Paramoceros) palmatus*, new species

From New Mexico

TYPE.—Left horn on cranial fragment, tips broken. Crotch is noticeably palmate.

F:A.M.31580

From Santa Fé area, 1925. This paper, *Figs. 33, 34.*

(9) *R. (Paramoceros) brevicornis*, new subgenus and species

From Barstow, California

SUBGENOTYPE.—Frontal saddle with horns, shaft short, heavy three-tined crotch. Burrless.

F:A.M.31348

From Skyline Quarry, 1933. Collected by Jack Wilson. This paper, *Fig. 35.*

REFERRED.—

Left horn on frontal fragment, points broken, with burr.

F:A.M.31349

From above Skyline, 1933. This paper, *Fig. 35.*

Size moderate.

IB. **MERRIAMOCEROS**, NEW SUBGENUS

Reconstruction, Frontispiece, A

(10) **R. (*Merriamoceros*) coronatus** (Merriam), subgenotypic species

From Barstow, California

Merycodus(?) coronatus MERRIAM, 1913, Univ. Cal. Pub. Bull. Dept. Geol., VII, p. 335, Figs. 1-3; 1919, *ibid.*, XI, p. 521, Figs. 135a-c.

This peculiar pronglet is represented in the new collections by a crushed cranium with partial dentition and unsymmetrical horn-cores, some fifteen listed detached cores, six listed mandibular rami with symphyses preserved and a number of partial rami. The majority of these remains were secured from Steepside Quarry of the Green Hills horizon by the Jack Wilson party in the winter and spring of 1936. The horns and mandibular dentitions are sufficient witness to the distinctness of the form, which remains unrecognized beyond the Green Hills deposit.

The "horn" (Figs. 28D, 35, 35A) consists of an erect supra-orbital shaft bearing an elongate, somewhat expanded and horizontally lying summit. The superior border of the orbit extends to an unusual degree within the base of the shaft. The shaft apparently was directed slightly outwardly and anteriorly. It is somewhat flattened, particularly at the fork, externally at this point being convex and inwardly concave to deeply cupped. In the smaller and what appear to be less aged specimens (exemplified in the unsymmetrical horns of the only known skull), the underlying structure of elementary anterior and double posterior prongs is visible. In the larger individuals the whole top of the horn—the equivalent of the typical anterior prong and double posterior prongs—is extended in a general palmate surface whose periphery bristles with ten or more tubercular-like points. None of the specimens retains a burr (if this were ever present). The bullæ, as seen in the one cranium, are small. A series of mandibular rami, six with symphyses preserved, was secured with the horns. The diastema is short and slender and the p_2 proportionately large. The specimens fall in Size Groups III to III-. A metacarpus of moderately heavy proportions is credited to the species. The mandibular characters (Figs. 35A, 47A) indicate that *Merriamoceros* may prove most nearly related to the Sioux County *Paracosoryx*.

John C. Merriam (1913, p. 338) observes that the peculiarities of the type specimen "... may be accounted for on the assumption that it is a 'sport' or 'monstrosity' of *Merycodus necatus*, a common form in the Mojave region ..." but (1919, p. 524) believes it "... desirable to recognize this form as distinct from other species and probably nearest to *Merycodus*."

SUBGENOTYPE.—Partial horn- U.C.20052 Figured by Merriam, 1913,
core. Figs. 1-3; 1919, Figs. 135a-c.
Size large.

REFERRED (collected by Jack Wilson and associates).—

(a) From Steepside Quarry, 1936:

Posterior two-thirds of cranium (crushed) with unsymmetri- F:A.M.
cal horn-cores and left m¹-m³. (Small individual). (w) 31025

Five large-sized specimens:

Right horn on cranial fragment. (Eleven or more points.) *Fig. 35A* 31146
Left horn on cranial fragment. 31024
Right horn (possibly same individual as above). *Fig. 35A* 31024A
Right horn on cranial fragment. (The most massive speci-
men.) 31037
Right horn. 31037A

Four moderate-sized specimens:

Right horn on cranial fragment. (Smallest of the four
specimens.) *Fig. 35A* 31022
Right horn on cranial fragment. 31037B
Left horn on cranial fragment. 31021
Left horn on cranial fragment. (This and F:A.M.31350
present the simplest and least expanded horns.) 31147

Five smaller-sized specimens:

Left horn on cranial fragment. 31148
Left horn on cranial fragment. 31149
Right horn on cranial fragment. 31023

From Green Hills, indefinite locality, 1930 and 1932:

8+ pointed horn. *Fig. 35* 31351
Left horn on cranial fragment. (But 3 anterior and 3 pos-
terior points.) *Fig. 35* 31350
Also 9 fragmental horns, F:A.M. Coll.

(b) Variant A, from Yermo, 1932:

Portion of orbit bearing right horn (and possibly associated
basal fragment of left horn). Anterior and posterior ex-
tremities of summit subequal, shaft at fork deeply cupped
inwardly. Perhaps nearest approached by F:A.M.
31148. *Fig. 35A* 31177

(See referred rami, Dentition Section III, page 437; and metacarpus, Limb Section IV, page 455.) (Note lately secured large horn, F:A.M.31145, Fig. 28D, and mandibular ramus, F:A.M.31144, Fig. 47A.)

II. COSORYX LEIDY (AND SUBCOSORYX, PARACOSORYX AND SUBPARACOSORYX, NEW SUBGENERA)

Reconstructions, Figure 27AA, B, BB

The genus *Cosoryx*, as noted above, may prove to be synonymous with *Merycodus* Leidy, should it ever be possible to definitely determine the latter. The genotypic species is *C. furcatus* Leidy and the genotype is a partial horn-core from the Niobrara, which is characterized by relative slenderness and circular cross section of its shaft.

Cosoryx is best portrayed in referred remains secured by Morris F. Skinner from the so-called Gordon Creek and Midway Quarries, Cherry County, Nebraska. The tall slender-shafted horns of small to larger size are very similar to the type of *C. furcatus* Leidy from the Niobrara and to a specimen with partial mandible from Hitchcock County, Nebraska (A.M.8497). Certain of the smaller horns are not unsuggestive of a Colorado specimen heretofore known as the "cotype of *M. osborni*" (A.M.9475). While the teeth are noticeably heavier, the crania and limbs are smaller, the muzzle proportionately shorter and the nasals more abbreviated and slender as compared to the Crookston *Meryceros*. The premaxilla, nasals and /Is are known to the writer in but a single immature specimen (F:A.M.32450, Fig. 26) from Gordon Creek. A partial skull of a female (F:A.M.32426, Fig. 26) from the same area is the only Merycodontine specimen preserving the pterygoids.

A collection of one hundred and six mandibular rami, forty-six maxillæ, eighty-nine horns and many other remains,¹ secured while these pages were coming through the press, introduces an heretofore unknown *Cosoryx*, remarkable for the reduction of the premolars. This highly specialized form is referred to a distinct subgenus and species, *Cosoryx (Subcosoryx) cerroensis*. The specimens were quarried from an unusually rich fossiliferous stratum, lying directly beneath the heavy conglomerates of the Pajarito Plateau on the western bank of the Rio Grande and discovered by William Klaus of our Santa Fé field party. The horns are of generally slender proportions with elongate forks. The shafts range from short-moderate to tall; the forks, from moderate to very widely branching, or exceptionally, non-spreading. Certain of the taller-shafted, more moderate-forked specimens suggest the type of *Co-*

¹ Four hundred and thirty mature and two hundred and ten immature unlisted partial and fragmental rami; one hundred and forty mature and thirty-four immature unlisted partial maxillæ and numerous detached upper teeth.

soryx ilfonsensis. (A single three-pronged horn-core associated with the same collection is referred to *Paramoceros marthæ*.) The mandibular rami range between Size Groups III–V and are of generally uniform character, with long diastema and extremely reduced p_2 – p_3 . The nub-like p_2 is occasionally lost. (A single specimen, exhibiting a noticeably short diastema and retaining the p_2 germ unerupted, is considered as an abnormality. Two fragmental specimens differ from the main series in the large size of the p_4 and p_3 (retained only in one specimen) and, like the above horn, are referred tentatively to the above species, *R. (P.) marthæ*.)

The full-fledged Midway limbs are small as compared to *Meryceros* of Crookston. And while the metacarpus approximates, the metatarsus is much shorter than in the mount of the genotype of *Ramoceros osborni* (Matthew). The Round Mountain Quarry limbs are considerably larger than the Midway. They are of about the size of the moderately small individuals of the Crookston collection.

Re (a) Midway and (b) Gordon Creek *Cosoryx* Series:

(a) The Midway Quarry series includes two posterior crania with burred horns, seven posterior crania without horns (females), and seven detached horn-cores, only two of these with burr. (The general slenderness of the burrless specimens evidences young individuals). The mandibular rami (see Dentition Section III, page 414) include some one hundred and twenty-four largely complete lower dentitions, ninety of mature and thirty-four of immature individuals, almost again as many less complete to fragmentary specimens, and a considerable number of maxillary or partial maxillary dentitions. A moderate variation is seen in the size of the teeth and rami, the limits being exemplified by the small specimen, F:A.M.32362, and the large specimen, F:A.M.32354. Some ten rami have the premolars complete and another ten have the dentition complete save for the p_2 . The p_2 at times was absent in life, as shown by absence of alveolus. The lower incisors are not preserved in any specimen. The series includes a large assortment of limb elements (see Limb Section IV, page 458), the great majority of which, strangely enough, represent immature individuals.

(b) The Gordon Creek Quarry collection contains a large percentage of partial crania, with a predominance of males. The horn-cores include a very diminutive specimen (an immature individual) as well as the tallest specimen of the entire *Cosoryx* series. The height of the latter horn-core (N.S.M.15-27-7-29) approximates that of the differently propor-

tioned *Paracosoryx wilsoni* subgenotype from Long Quarry, Sioux County. As noted above, the series includes the only *Cosoryx* specimens with the premaxilla and nasals at present known to the writer, and the only Merycodontine specimen retaining the pterygoids.

Cosoryx is now represented by remains from New Mexico; Kansas; Montana; Brown, Cherry and Hitchcock Counties, Nebraska; and Colorado.

A subgenus, *Paracosoryx*, replaces the genus in Sioux County, Nebraska, and Barstow, California. The same is characterized by height of the burr, tendency at times to extreme elongation of the horn shaft, and shortness of the diastema. The subgenotypic species is *P. wilsoni* of Sioux County. A species, *P. furlongi*, from the Ricardo Pliocene is referred to the subgenus, which, by study of the literature, seems to be represented in the University of California collections from Tejon Hills, Virgin Valley and Tonopah,¹ Nevada. The first subgenus, *Subcosoryx*, so far recognized only from one New Mexican locality, is characterized by the extreme reduction of the premolars, as noted above.

[See discussion of the genus, page 292, and see summary of fifteen here recognized *Cosoryx*, *Paracosoryx* and *Subcosoryx* species and sub-species (exclusive of unnamed), page 318.]

(1) **C. (Subcosoryx) cerroensis**, new subgenus and species

From Round Mountain Quarry, New Mexico

SUBGENOTYPE.—See Dentition Section III, page 392.

REFERRED, EIGHTY-NINE "HORN" SPECIMENS (anterior tine the longer).—

Typical specimens with long shaft and long tines with tendency to rather wide flare and bending of tips:

Large to moderate, with tendency to enlargement in both shaft and tine:

	F:A.M.
Right horn, tips broken.....	33104
Right horn, tips missing.....	33106
Right horn with double burr, on cranial fragment.....	33107
Right and left horns.....	33107A,B
Left horn with burr.....	33107C
Pair of horns with burrs, on cranial saddle.....	33109
Left horn.....	33114E
Right shaft, forks broken.....	33109A

¹ C. (*Paracosoryx*) *loxocerus* (Furlong, 1935), from Tonopah.

	F:A.M.
Right and left horns with burrs.....	33114C,F
Two forks.....	33111B,C
Right horn with double burr.....	33108
Left horn with double burr.....	33110
Left horn with burr.....	33108C
Right and left horns.....	33115C,B
Left horn with double burr, posterior tip broken...	33108D
Left horn with trace of burr.....	33110A
Left horn (see ?associated left ramus, page 394)...	33112
Pair of horns, left with burr.....	33115
Right horn.....	33115A
Left horn, tips broken.....	33108A
Left horn on cranial fragment, posterior tip broken	33108B
Left horn with burr.....	33114D
Two right horns with burrs.....	33110B,E
Right horn with burr.....	33110H
Right horn, trace of burr and fragment of left horn.	33110C
Two right horns with trace of burr.....	33110I,F
Two right horns with burrs.....	33110D,G
Left horn.....	33110J

Fig. 38

Smaller:

Right horn with burr.....	33111E
Right and left horns.....	33111D,F
Left and right horns with burrs.....	33111G,N
Right horn.....	33110K
Three right horns with burrs.....	33111A,H,I
Left horn, tips broken.....	33112B
Right horn with double burr.....	33110M
Left horn with burr, tips broken.....	33113B
Left horn with burr (and fragment of ?right)....	33110P
Left horn with burr, on cranial fragment, and fragments of right horn.....	33113
Left horn, tips broken.....	33115D
Left crushed horn with burr.....	33113A
Left horn with double burr, tips broken.....	33112D
Left crushed horn.....	33113C
Left horn with burr, base broken.....	33110L
Right horn with burr.....	33113E
Right horn with double burr.....	33112C
Left horn with burr, tips broken.....	33113G
Right horn.....	33113F
Left horn with double burr.....	33113H
Right horn with burr, tips broken.....	33113D

Fig. 38

Smallest size:

Left horn, tips broken.....	33113I
Right horn.....	33113J

Less typical, including variants having:

Shorter shafts with wide-spread tines (the extreme being shown in F:A.M. 33105):

Right horn fragment (suggestive of heavier specimens from Santa Cruz, F:A.M.31439).....	<i>Fig. 38</i>	F:A.M. 33105
Right horn (br.) with burr, on cranial fragment.		33104A
Right horn.....	<i>Fig. 38</i>	33116
Pair of horns with burr, bases broken.....		33116A
Right horn with burr.....		33116B
Left horn with burr, posterior fork broken.....		33116C
Right horn with heavy double burr.....		33116D
Left horn with burr.....		33116E
Right horn with burr.....		33114B
Left horn (anterior tine much longer).....		33120

Several cranial saddles indicate the presence of individuals in which the horn-cores are peculiarly rotated antero-inwardly:

Cranial saddle with pair of heavy horn-cores with burrs.....	33121
Pair of horn-cores with extremely heavy burrs...	33122
Cranial saddle with both horns with burrs.....	33119
Cranial saddle with both horns with burrs.....	33118
Left horn with burr (and ?associated mandible, page 393).....	33117

Certain new Round Mountain specimens closely resemble specimens of the following species, *Cosoryx ilfonsensis*. These specimens are held with the above Round Mountain material only for the matter of present convenience. The specimens average large for association with the small dentitions with reduced pre-molars from the same beds. These specimens, like the horn-cores of *C. ilfonsensis* and of the New Year Quarry, Barstow, the M.C.Z. Garman-Scott specimen, the tall horn from Burge Quarry, and, in less degree, the type horn of *Meryceros crucensis*, in their elongate shafts and short-tined forks, are suggestive of a massively developed *Paracosoryx*—excepting that they lack the elevated burrs typical of the latter. A very similar horn has recently been observed from Sheridan County and from Morrill County, Nebraska (page 354).

Left horn.....	33123A
Left horn (crushed).....	33123

Tall shafts with short-tending tines:

Left horn with burr. (Very similar to San Ildefonso F:A.M.31499 and recalling the heavier M.C.Z. Garman Scott specimen.).....	33106A
Left horn.....	33106B
Right horn with burr.....	33111
Left horn with burr, posterior fork broken.....	33106C
Left crushed horn.....	33106E

	F:A.M.
Left horn, anterior fork broken.....	33106D
Left horn with double burr, anterior fork broken..	33106F
Pair of horns with burrs.....	<i>Fig. 38</i> 33114

Two immature specimens:

Crushed cranial fragment with parts of both horns with burrs.....	33118A
?Right horn.....	33118B

See referred rami and maxillæ, Dentition Section III, page 392; and limbs, Limb Section IV, page 456.

(2) *Cosoryx ilfonsensis*, new species¹

From New Mexico

(See discussion on opposite page)

TYPE.—Top of cranium and horns, with burr.	F:A.M.31435	From San Ildefonso, near spring, 1933. This paper, <i>Figs. 36, 36A.</i>
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REFERRED.—

(a) Four moderate-sized specimens (similar to F:A.M.31435):

Cranial saddle with both horns, burred.	F:A.M.31499	From San Ildefonso, 1935.
Left horn on cranial frag- ment.	F:A.M.31464	From Santa Clara, 1928.
Partial horn, without burr.	F:A.M.31436	From Pojuaque, on road to Chimayo, 1925.
Partial horn, without burr.	F:A.M.31437	From Skull Ridge, 1927.

(b) Three very large-sized specimens (larger than any other cores referred to *Cosoryx*—and almost equally suggestive of a variation of *M. major*):

Left horn.	F:A.M.31440	From Santa Fé area, 1927.
Left horn, points broken.	F:A.M.31442	From Santa Clara, 1928.
Horn, points broken. (Tallest.)	F:A.M.31438	From Santa Cruz.

¹ In discussions of horns from the Santa Fé marls, E. D. Cope (1877), under his *Dicrocerus furcatus*, figures no specimen of the typical *furcatus* form nor that could be referred to this species. Cope (1875, Proc. Acad. Nat. Sci. Phila., XXVII, p. 257) lists several specimens of *Merycodus*, *Cervus* and *Cosoryx*, transferred to the Gervais genus.

(3) *Cosoryx furcatus* Leidy, genotypic species

From the Niobrara; referred remains from
Cherry, Brown and Hitchcock Counties, Nebraska

(See previous discussion, page 335.)

Cosoryx furcatus LEIDY, 1869, Journ. Acad. Nat. Sci. Phila., VII, p. 173, Pl. xxviii, Fig. 8. SCOTT, 1890, Bull. Mus. Comp. Zool., XX, p. 82, Pl. I (referred remains). 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, p. 31.

GENOTYPE.—Partial horn-core with straight cylindrical shaft, measuring $2\frac{1}{2}$ inches.	N.M.148 [A.M.9994, cast]	From the Niobrara. Figured by Leidy, 1869, Pl. xxviii, Fig. 8.
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REFERRED.—

Leidy, 1869, from the Niobrara:

"A second and more cylindrical specimen."	A.M.9994A [Cast]
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Fort Niobrara, American Museum collection:

Four horn fragments, and fragment without burr.	A.M.8572 and A
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New material from:

Cherry County localities: (a) Midway Quarry, (b) Gordon Creek, (c) Swallow, Snake River, (c') Steer Creek and Snake River localities, (c'') Talus, 100 feet (Midway Channel) below Xmas Quarry, (d) Burge Quarry (new var.);

Brown County localities: (e) Long Pine, (f) Moore Creek, (g) Above Devil's Gulch, (h¹) Id., near Jamison's, (h²) Horsethief Canyon;

(i) Garman Loup Fork (large var.), and from (j) Hitchcock County.

(a) Midway Quarry (horns fully as small and slender as the genotype):

Posterior cranium with burred horn-cores.	F:A.M.32376
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Posterior cranium with burred right horn-core.	F:A.M.32377	This paper, <i>Figs. 36, 36A,</i>
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Left horn-core with burr.	F:A.M.32378
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Five burrless horn-cores, evidently immature.	F:A.M.32379 and A-D
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Basal fragment of horn- core with burr; and fork.	F:A.M.32380 and A
--	-------------------

Burred horn-core and fork of core. ? <i>Meryceros</i> .	F:A.M.32381 and 32380B
--	------------------------

Seven posterior crania F:A.M.32382 and A-F
(hornless).

(For ramal and maxillary dentitions, see Section III, page 414; for limb elements, see Section IV, page 458.)

(b) Gordon Creek:

Nebraska State Museum specimens from east side of Gordon Creek, about $\frac{1}{4}$ mile north of the falls, 50 feet below top of canyon:

Greater part of skull, part of left frontlet of a second, and two immature horn- cores of a third and a fourth individual.	N.S.M.1-9-8-28	This paper, <i>Figs. 36, 36A</i> (horn).
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("Skeletal elements from same pit may include parts of same individual.")

Partial horn-core, imma- ture.	N.S.M.1-9-8-28
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Four from P. H. Young Ranch (on Gordon Creek):

Left horn-core.	N.S.M.15-24-7-29
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Tallest of the series, approximating *Paracosoryx wilsoni* in height.

Partial horn-core.	N.S.M.35-27-7-29
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Partial right horn-core.	N.S.M.12-19-7-29
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Partial horn-core.	N.S.M.17-1-8-29
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F:A.M. Collection specimens from Gordon Creek Quarry, 1934 (near genotype):

Immature skull and jaws, premaxilla and /dIs pre- served, $dp_2^2-m_2^2$, atlas, ♀.	F:A.M.32450	This paper, <i>Fig. 26</i> .
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(Brain case broken.) (See associated limbs, Section IV, page 458.)

Cranium, anterior muzzle missing, pterygoids, etc., preserved, p^2-m^2 , ♀. (M)	F:A.M.32426	This paper, <i>Fig. 26</i> .
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Posterior cranium with left burred horn-core.	F:A.M.32427
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Cranial saddle with left burred horn-core and base of right.	F:A.M.32428
--	-------------

Posterior cranial fragment, hornless, ♀.	F:A.M.32429
---	-------------

Cranial fragments, at- F:A.M.32431
tached right horn-core
and detached left horn-
core.

Largest of the series and slightly taller than the genotype.

Broken left horn-core and F:A.M.32432 and A
fragment of left core, burr-
less.

Nine horn fragments
(three with burr).

(For ramal and maxillary dentitions, see Section III, page 416; for limb elements, see Section IV, page 458.)

(c) Swallow Quarry, Snake River:

Nearly complete skull N.S.M.25-22-6-34
with left horn base, p^2 al-
veolus and p^3-m^2 . (M+)

Nearly complete skull, ♀, N.S.M.3-27-6-34
with p^2-m^2 . (M+)

Left horn-core on frontlet, N.S.M.10-26-6-34
burrless.

(Only moderately smaller than Scott's specimen.)

(And see maxilla and rami, Dentition Section III, page 417; and limbs, Section IV, page 459.)

(c') Steer Creek and Snake River localities:

Right burrless horn-core N.S.M.3-28-6-35
on portion of frontlet.

Left burrless horn-core on N.S.M.10-27-6-34
portion of frontlet.

Right burrless horn-core. N.S.M.27-25-6-32 (General area.)

(c'') Talus, 100 feet ("Midway Channel") below Xmas Quarry:

Horn base without burr. F:A.M.31277 1933.

(d) Burge Quarry:

Cranium, premaxilla re- F:A.M.32902 This paper, *Figs. 2, 37A*.
tained, with p^2-m^2 . (M+)

(Top of saddle between horns showing ossification from an evident injury.)

Posterior portion of cra- F:A.M.32903
nium with both horns,
burrless.

Crushed cranium with dp^1 -
 m^2 , and right ramus with
 dp , m^2 , q .

F:A.M.32904

Four horns, moderate.

F:A.M.32900B-E

Horn, tall and slender.

F:A.M.32900A This paper, *Fig. 37A*.

Horn, small, immature.

F:A.M.32900F This paper, *Fig. 37A*.

(See Dentition Section III, page 418; and Limb Section IV, page 460.)

Notably taller than the above specimens and, unlike the latter, highly suggestive of *Paracosoryx*—say *P. burgensis*, n.sp. A radius (F:A.M.32912) and metacarpus (F:A.M.32913), approximating the large Nenzel versus the smaller Burge limbs, may pertain to the same form:

TYPE.—Right horn on F:A.M.32900 This paper, *Fig. 37A*.
 frontlet, burrless.

(Species *P. burgensis* is not included in the preceding enumeration of species.)

(e) Nine miles north of Long Pine, 1933:

Pair of horns with burr. F:A.M.31272 This paper, *Figs. 36, 36A*.

(Only moderately smaller than Scott's specimen.)

Two fragments with F:A.M.31273 1933.
 slightly shorter shaft,
 without burr.

(See possibly associated ramus, F:A.M.31273A, Dentition Section III, page 423.)

(f) Moore Creek:

Horn fragment with burr, F:A.M.31274 1929.
 and skull fragment.

(See ?associated rami, F:A.M.31274, Dentition Section III, page 419; this paper, *Fig. 45*.)

Three fragments without F:A.M.31278 Locality questioned.
 burr.

(g) Above Devil's Gulch:

Basal fragment with burr; F:A.M.31275 From talus slope, 1932.
 (and ?fragments of scapula).

(h¹) Id., near Jamison's:

Right fragment on frontal. N.S.M. Coll.

Right fragment. N.S.M.4-3-11-13 (Plum Creek.)

Fragment. N.S.M.3-3-11-13

(h²) Horsethief Canyon:

Top of immature cranium F:A.M.31189 From No. 1 lower zone 1934.
with immature horn-nubs.

(i) Garman Loup Fork Collection (*C. furcatus*, large var.):

This specimen is that described and figured in reconstruction by William B. Scott in 1890. The horn is larger than the Leidy type specimen.

Left horn-core, partial	M.C.Z.10101	Skeleton figured by Scott,
mandible, m ¹ , one-half	[F:A.M. cast]	1890, under <i>Cosoryx furca-</i>
pelvis, portion of scapula,		<i>tus</i> referred; ramus, this
series of vertebrae, meta-		paper, <i>Fig. 45</i> .
podial.		

(See Dentition Section III, pages 418, 429; Limb Section IV, page 460.)

(j) Hitchcock County, Southern Nebraska:

Top of cranium and	A.M.8497	From Driftwood Creek, 1879.
horns, with burr.		This paper, <i>Figs. 23, 36</i> .

Labeled "*Merycodus furcatus* Leidy." (See ramus under same number, Dentition Section III, page 434.)

(4) *Cosoryx furcatus sternbergi*, new subspecies

From Kansas

TYPE.—Top of cranium and	F:A.M.31511	From Section 1, 2 mi. S. and
horns, with burr.		$\frac{3}{4}$ mi. E. of Dinsmore,
		Kansas, 1933.
		This paper, <i>Figs. 23, 23A, 36,</i>
		<i>36A</i> (cranium and horns),
		<i>43</i> (ramus).

(See associated left ramus, Dentition Section III, page 410.)

(5) *Cosoryx furcatus*, Var. or Subspecies

From South Dakota

EXAMPLE.—Right horn, with	A.M.10966	From Little White River,
burr, on frontal fragment.		South Dakota, 1903.
(Size moderately large.)		

REFERRED.—

Horn, with burr. (Size small.)	A.M.10963	From 15 mi. N.E. of Rosebud Agency, South Dakota, 1903.
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(See questionably referred limb elements, Section IV, page 461.)

The above specimens may prove the equivalent of *Merycodus necatus* Leidy described from the general area. The present whereabouts of the type is unknown. The same evidently represented a relatively large form. The type never has been figured, and the genus and species at the present writing seem to be indeterminate. The evidence may be recorded for comparison, i.e.:

(5a) *Merycodus necatus* Leidy, 1854, indeterminate genotypic species

From Bijou Hills, South Dakota

Merycodus necatus LEIDY, 1854, Proc. Acad. Nat. Sci. Phila., VII, p. 90; 1857, *ibid.*, IX, p. 89 (merely lists); 1869, Journ. Acad. Nat. Sci. Phila., VII, p. 162.

GENOTYPE.—Ramal fragment ?Lost
with p_4 - m_1 .

According to Leidy "allied to Musks":

p_4 anteroposterior distance = 8 mm., and

m_1 = 8 (approaching Size Group II).

(6) *Cosoryx furcatus mooki*, new subspecies

From Montana

TYPE.—Partial cranium with m^1 - m^2 and horns, with burr.	A.M.21370	From 10 miles S. of Logan, Montana. Collected by C. C. Mook and C. S. Williams, 1925. This paper, <i>Fig. 36A</i> .
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(See associated ramal fragment, Dentition Section III, page 411.)

C. f. mooki may prove to be synonymous with—

(6a) (?) *Cosoryx agilis* Douglass (indeterminate)

From Madison Valley Beds, Montana

Cosoryx agilis DOUGLASS, 1899, The Neocene Lake Beds of Western Montana, Univ. Mont., Thesis, p. 23, Pl. iv, Fig. 1.

Merycodus ? agilis (DOUGLASS), 1903, Ann. Carn. Mus., II, p. 155.

TYPE.—Immature partial skull, with mandible and partial manus, pes, radius, ulna, etc.	C.M.703	Figured by Douglass, 1899, Pl. iv, Fig. 1.
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Absence of horns suggests female.

According to Douglass, premolars = 45 mm., molars = 27.5 mm.

(See Dentition Section III, page 411, and Limb Section IV, page 461.)

(6b) (?) *Cosoryx* Var.

From Montana

The very interesting collection of C. E. Marshall contains a left immature ramus (No. 2) and a left ramus with m_2 - m_3 (No. 2a) from the Late Tertiary deposits on the Yellowstone River near the Gardiner entrance to Yellowstone National Park. (See Dentition Section III, page 411.) A right horn-core (points missing), 1-F-MV, of a large individual of *Cosoryx* has been called to our attention through the kindness of C. A. Kinsey of Belgrade, Montana.

(7) *Cosoryx furcatus*, Var. or Subspecies

From Colorado

EXAMPLE.—Portion of horn and possibly associated right maxilla with p^2 - m^3 .	A.M.22710	From 40 mi. N. of Sterling, Colorado, 1901.
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(See Dentition Section III, page 407.)

TENTATIVELY REFERRED.—

Cranial saddle with horn-cores.	A.M.9475	From Cedar Creek, 1901. Figured by Matthew, 1904, Fig. 4.
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Specimen heretofore known as part of "cotype" of *M. osborni* Matthew. (See questionably associated ramus and maxilla, Dentition Section III, page 406; and limb elements, Limb Section IV, page 461.)

QUESTIONABLY REFERRED.—

Left horn, without burr, on cranial fragment. (?)Immature.	F:A.M.31296	Collected by John C. Blick, Pawnee Creek, east of camp, 1932. This paper, <i>Figs. 36, 36A.</i>
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(8) *C. (Paracosoryx) alticornis*, new species

From First Division, Barstow, California

Shaft unusually slender and elongate

TYPE.—Extremely elongate horn, flattened at the fork, proximal end missing and evidence as to burr in ques- tion. Height at crotch = 155 + mm.	F:A.M.31154	From Skyline Quarry, 1933. Collected by Jack Wilson and associates. This paper, <i>Fig. 38A.</i>
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REFERRED.—

Top of cranium and broken horns with burr. (Horn bases connected by unusual elevation of the frontals.)	F:A.M.31153	From Skyline Quarry, 1933. This paper, <i>Fig. 38A.</i>
Horn with burr, tips miss- ing. (Specimen as heavy, but considerably shorter than type.)	F:A.M.31159	From North End, 1931. This paper, <i>Fig. 39A.</i>

Horns that, with one exception (F:A.M.31159), are slenderer than the type, and are notably more elongate than in the following New Year Quarry variant.

Top of cranium and horns, with burr.	F:A.M.31150	From North End, lower layer, 1930. This paper, <i>Fig. 38A.</i>
Right horn without burr.	F:A.M.31151	From Mayday Quarry, 1933. This paper, <i>Fig. 38A.</i>
Left horn, with burr, on cranial fragment.	F:A.M.31171	From Mayday Quarry, 1934.
Right horn without burr.	F:A.M.31152	From Skyline Quarry, 1933.
Left horn, without burr, on cranial fragment.	F:A.M.31170	From Starlight Quarry, 1934.

(See referred maxillæ and rami, Dentition Section III, pages 437–438, 443; and limbs, Limb Section IV, page 461.)

(8a) (?)Var. or *Cosoryx* species

From New Year Quarry, First Division, Barstow, California, 1934

Horns shorter and heavier-proportioned than in above. Specimens more resembling certain of the large *Cosoryx* forms, as *C. ilfonsensis*.

EXAMPLE.—Left horn on cranial fragment, with burr. F:A.M.31175

REFERRED.—

Right horn on cranial fragment, with burr. F:A.M.31172

Left horn on cranial fragment, with burr. F:A.M.31173

Left horn on cranial fragment, without burr. F:A.M.31174

Left horn on cranial fragment, without burr. F:A.M.31176

(See referred maxillæ and rami, Dentition Section III, pages 438, 443.)

(9) *C. (Paracosoryx) furlongi*, new species

From the Ricardo Pliocene, California

Merycodus, near *necatus* LEIDY, MERRIAM, 1919, Univ. Cal. Pub. Bull. Dept. Geol., XI, p. 582, Fig. 234.

Merycodus cf. *furcatus* LEIDY, ref. FURLONG, 1927, *ibid.*, XVII, p. 147, Pl. xxiv, Fig. 3; Pl. xxvi, Fig. 1; and Pl. xxvii, Fig. 4.

The partial cranium with tall-shafted biforked horn-cores and associated ramus from the Ricardo (U.C.26795), figured by E. L. Furlong (1927, Pls. xxvi and xxvii), is taken as the type. The describer observes that the burrs are absent and that the posterior tine is rotated outwardly versus *M. necatus*, in which the same is parallel to the skull axis. The shaft, while of approximately the same length, seems heavier than in Barstow, F:A.M.31150, in which the burrs are present. The horns are shown as slanting more forwardly than is usual in *Cosoryx* specimens from the Great Plains area.

John C. Merriam (1919) notes and figures, among other remains from the Ricardo area, a partial horn-core with tall, slender beam (U.C. 23448, Fig. 235). He also figures an m_3 in which the third lobe is tend-

ing to division, the specimen to him seeming to be suggestive of *Capromeryx*.

TYPE.—Partial cranium with tall horn, maxillary series, ramus, etc. U.C.26795 Figured by Furlong, 1927, Pl. xxiv, Fig. 3; Pl. xxvi, Fig. 1; and Pl. xxvii, Fig. 4.

(See Dentition Section III, page 444; and associated metatarsus, Limb Section IV, page 462.)

REFERRED.—

Three horn-cores (one with burr). U.C.27243 Figured by Furlong, 1927, Pl. xxviii, Figs. 1-3, under "Merycodus species."
27249
27242

Et cetera remains in the University of California collection.

Et cetera ramal fragments in the writer's collection, see Dentition Section III, page 444.

(10) C. (*Paracosoryx*) species

From the Tejon Hills, California

Merycodus, near *necatus* LEIDY, ref. MERRIAM, 1916, Univ. Cal. Pub. Bull. Dept. Geol., X, p. 127, Fig. 17.

EXAMPLE.—Partial antler. U.C.22332 From Chanac fauna of Tejon Hills.
Writer notes the flat elongate forked shaft. Figured by Merriam, 1916, Fig. 17.

(11) C. (*Paracosoryx*) *loxocerus* (Furlong)

From the Vicinity of Tonopah, Nevada

Merycodus loxocerus Furlong, 1935, Carn. Inst. Wash. Pub. 453, p. 4, Pls. I-II; III, Figs. 1-4; IV, Figs. 1-5.

A tall slender-shafted and short anterior-tined species from the vicinity of Tonopah has been described recently by E. L. Furlong. The cores are reported to be strongly inclined posteriorly. A backward inclination to such degree might be questioned as previously unobserved.

TYPE.—Right ramus, p_2-m_3 . C.I.T.1301 Figured by Furlong, 1935, Pl. II, Figs. 4, a-b.
(See Dentition Section III, page 445.)

REFERRED AND FIGURED BY FURLONG, 1935.—

Frontlet with burrless horn-core shafts.	C.I.T.1447	Pl. I, Figs. 1 and 1a.
Frontlet with burred horn-cores (immature).	C.I.T.698	Pl. I, Figs. 2 and 2a.
Frontlet with burred horn-cores.	C.I.T.705	Pl. II, Figs. 1 and 1a.
Frontlet with burred horn-core shafts.	C.I.T.697	Pl. II, Figs. 2 and 2a (abnormal).
Frontlet with burred horn-cores.	C.I.T.696	Pl. III, Figs. 1 and 1a.
(Apparently the best example of the tallest horns.)		
Burred horn-core.	C.I.T.707	Pl. IV, Figs. 1 and 1a.

(11a) (?) *C. (Paracosoryx) nevadensis* (Merriam)

From High Rock Canyon, Nevada

Merycodus nevadensis MERRIAM, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 284, Fig. 65.

TYPE.—Left fragment with U.C.12608 From High Rock Canyon.
 m_1 – m_3 . Figured by Merriam, 1911,
 Fig. 65.

Merriam (1911, p. 285) states "... this form was considerably smaller than *M. furcatus*, *M. necatus*, and *M. osborni*."

m_2 = 7.6 mm.; m_3 = 11.5

(See Dentition Section III, page 445.)

(11b) *C. (Paracosoryx)* Var.

From Virgin Valley, Nevada

Merycodus, near *furcatus* (LEIDY), MERRIAM, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 284, Fig. 66.

Examined by a slender antler (U.C.11319), the shaft of which, according to the author, up to point of branching, measures 110 mm. (Fig. 66, p. 284). The type of *Merycodus nevadensis* Merriam (1911) from High Rock Canyon may represent the same form, and in such case the species becomes *P. nevadensis* (Merriam).

(12) (?) *C. (Paracosoryx)* species (Gazin)

From Skull Spring Miocene, Oregon

Merycodus ? species a and b GAZIN, 1932, Carn. Inst. Wash. Pub. 418, p. 85, Fig. 19a.

EXAMPLE.—Right fragment of C.I.T.383 From Malheur County, Oregon.
immature ramus, dp_4-m_2 .
(See Dentition Section III, page 445.) Figured by Gazin, 1932, Fig. 19a.

(13) *C. (Paracosoryx) wilsoni*, new subgenus and species

From Sioux County, Nebraska

SUBGENOTYPE.—Crushed skull F:A.M.32470 From Long Quarry, 1935.
with tall, slender horns Collected by Jack Wilson and
with burrs and p^2-m^3 , associates.
muzzle missing. (w) This paper, Fig. 37.

Height at crotch = 91 mm.

The horns are notable in height of shaft and reduction of fork. While resembling *Paramoceros* of the Barstow area in the height and slenderness of the shaft, the horns are smaller and the short distal forks possibly more dished inwardly. Two more recently secured specimens are of interest: F:A.M.32886 exhibits a taller shaft than any of those here listed (height 128+ mm.); F:A.M. 32887 is unique in that the burr is situated only slightly below the fork. Lateral splints and phalanges are retained in the manus of the skeleton of an immature individual, F:A.M.33789, page 316 and Figs. 25B, 48A.

REFERRED FROM TYPE LOCALITY.—

F:A.M.

Crushed skull with tall, slender horns and p^2-m^3 , muzzle and burrs missing. (Height at crotch 102 mm.)	(m) Fig. 37	31191
Partial skull with horns and p^2-m^3 . [Horns extremely interesting, as noted above; anterior fork of left horn rudimentary, right shaft slenderer than left and exhibiting second burr at the base of the fork (missing). Shaft relatively short.]	(w) Fig. 37	32895
Posterior portion of skull with both horns, no burrs.		32896
Top of skull with right horn with burr, and right orbit.		32898
Extremely tall left horn with burr.	Fig. 37	32471
Right horn with burr on cranial fragment.		33000
Left horn fragment with burr.		33000A
Two right horns with burrs.		33000C-D
Left horn with burr.		33000H
Left horn without burr.		32473
Right horn with double burr on cranial fragment.	Fig. 37	31192
Right horn with burr.		32002
Right horn with burr on cranial fragment.		33000E

		F:A.M.
Right horn without burr.....		32472
Right horn with burr on cranial fragment.....		33000F
Left partial horn with burr.....		33000I
Right horn without burr.....		33000J
Shafts relatively short:		
Left horn with double burr.....		33000K
Right horn fragment without burr.....		32003
Horn fragment with triple burr.....		33000L
Five horn fragments.....		32473B, C
		33000G, M, N
Small fork.....		32004
Immature:		
Right horn with burr (fork rudimentary).....		33000B
Left horn with burr (fork rudimentary).....	Fig. 37	31192A
Seven female crushed partial skulls:		
Partial skull with p^2-m^3	(M)	32474
Partial skull with p^3-m^3 (erupting).....	(-M)	32475
Partial skull with p^2-m^3	(W+++)	32476
Posterior half skull with m^1-m^3 and orbits preserved	(M)	32899
Portion of skull with p^2-m^3 and orbits preserved...	(W+)	32899A
Portion of skull with p^2-m^3	(W)	32899B
Crushed skull with p^2-m^3	(W+)	32899C
Two fragments of skulls.....		32899D-E
REFERRED FROM ECHO QUARRY.—		
Horn fragment with burr.....		32473A
Small fork.....		32473D
Fragment of skull.....		32899F

See short-diastemaed rami (Dentition Section III, page 429) and limb elements (Limb Section IV, page 462) from Long Quarry, tentatively referred to this species.

Doubtfully Distinct

From Sioux County, Nebraska

Crotch of fork broadly expanded, possibly through injury. Specimen may represent a new species.

EXAMPLE.—Crushed posterior
cranium with tall horns
(distally broken) and
 m^1-m^3 . (M)

F:A.M.32399

From Long Quarry, 1934.
This paper, Fig. 26.

(14) *C. (Subparacosoryx) savaronis*, new subgenus and species

From Sioux County, Nebraska

(See discussion, page 288)

SUBGENOTYPE.—Posterior cranium with horns, m^1-m^2 . (w+)	A.M.17339	From Sinclair Quarry, 1916. Figured by Matthew, 1918, Fig. 18 (under <i>M. necatus</i> Leidy); this paper, Figs. 28, 28A.
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REFERRED.—

Posterior cranium without teeth.	A.M.17340	1916.
Partial cranium, crushed, with left horn, m^1-m^2 . (m+)	A.M.22746	1916. This paper, Fig. 39.
Broken posterior cranium without horns.	A.M.22744	From Quarry B, 1921.
Broken posterior cranium without horns.	A.M.22745	From Quarry B, 1921.

(And see referred rami, Dentition Section III, page 430.)

(14a) *C. (Paracosoryx) sabulonis* (Matthew and Cook), 1909

From Sioux County, Nebraska

Merycodus necatus sabulonis MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 411, Fig. 24.

Merycodus necatus LEIDY, referred MATTHEW, 1918, *ibid.*, XXXVIII, p. 219, Fig. 18.

Merycodus necatus sabulonis M. AND C., MATTHEW, 1924, *ibid.*, L, p. 200.

The type is a well-preserved right ramus in which the diastema is somewhat short as compared to the Santa Cruz remains, but moderately longer than in the shorter of the Snake Creek remains. It seems necessary, as noted above, pending the securing of more satisfactory evidence, to hold the possibly equivalent crania from the general area in a separate species, *S. savaronis*.

TYPE.—Right ramus with symphysis and p_2-m_2 . (m+)	A.M.14109	From Snake Creek area, Sioux County, 1908. Figured by Matthew and Cook, 1909, Fig. 24; this paper, Fig. 44.
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(See referred rami, Dentition Section III, page 430; and limbs, Section IV, page 462.) (And see fragments, A.M. collection.)

(15) *C. (Paracosoryx) dawesensis*, new species

From Dawes County, Nebraska

TYPE.—Left horn-core.

F.B:A.M.32856

From Ginn Quarry, 1935.

This paper, *Fig. 37*.

REFERRED FROM TYPE LOCALITY.—

Basal portion of two horn- F.B:A.M.32855,A
cores, with burrs.

(See Dentition Section III, page 434.)

(16) *C. (Paracosoryx)* species

From Sheridan County, Nebraska

(Not cited in Distribution Table VII)

EXAMPLE.—Frontlet with left N.S.M.9-1-8-33
horn-core (points broken).

(Height from top of orbits to crotch = 124 mm.)

(Not included in specimen count.)

This stout and recently received specimen recalls the question of the allocation of such similar specimens (page 338) as:

New Mexican *Cosoryx ilfonsensis*, questionably referred, 31440, height 98 mm., and 31442, height 94 mm. at crotch;

Nebraskan *Paracosoryx burgensis*, type, 32900, height 110 mm. (slenderer); (through the kindness of Professor E. H. Barbour, we have seen, since the setting-up of this page, a left frontlet with horn-core [N.S.M.10-18-36, Eunice Mauer Coll., from 8 miles south of Bridgeport, Morrill County, Nebraska], which closely resembles 32900 in form, but is of much larger size [height from top of orbits to crotch = 130 mm.]);

Mojave *Paracosoryx* or *Cosoryx* var., series including 31175, height 102 mm., which differ mainly from the *Meryceros crucensis* type, 31466, height 84 mm., in the more circular cross section of the shaft and absence of similar wedged condition of the fork.

III. *MERYCEROS*, NEW GENUS

Reconstruction, Figure 27A

The genotypic species is *M. warreni* (Leidy), from the Niobrara. (See discussion of characters of *Meryceros* and *Submeryceros*, page 293, and description of *M. nenzelensis*, page 359, and of *M. warreni johnsoni*, page 362.)

(1) ***Meryceros major*, new species**

From New Mexico

The type specimen is remarkable for its large size, tallness of the shaft and wide bowing of the fork. The tentatively referred specimens are of more normal size. The smaller of the latter tend to approximate certain of the wider-forked specimens of *Meryceros crucensis* (see M. "warreni"-like). A wide difference exists between the shape of the elongate and flaring type specimen and the referred heavy, compact F:A.M.31445.

(HORN OF UNUSUAL SIZE)

TYPE.—Left horn, proximal end of shaft missing. (No evidence re burr.)	F:A.M.31439	From Santa Cruz, 1928. Collected by Joseph Rak. This paper, <i>Fig. 39A</i> .
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TENTATIVELY REFERRED.—

Right horn on cranial fragment, without burr.	F:A.M.31448	From Santa Clara, 1928. This paper, <i>Fig. 39A</i> .
(Note somewhat similar specimen from Round Mountain Quarry, 1935.)		
Right shaft, points broken, trace of burr.	F:A.M.31396A	From Pojuaque Bluffs, 1935.
Partial left horn on cra- nial fragment.	F:A.M.31460	From White Operation, 1925.
Pair of partial horns on frontlets.	F:A.M.31396	From 1st wash, Santa Cruz, 1935.
Left horn on cranial frag- ment, without burr.	F:A.M.31450	From Santa Cruz, 1929.
Left horn, without burr.	F:A.M.31451	From Santa Cruz.

More compressed, wedge-like, points less spreading:

Moderate-sized:

Right horn on cranial frag- ment, without burr.	F:A.M.31461	From Santa Cruz.
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Larger-sized:

Right horn on cranial frag- ment, with burr.	F:A.M.31449	From Santa Cruz, 1928.
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(Shaft indicative of former burr.)

Fragmental horn.	F:A.M.31452	From Santa Cruz, 1929.
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Largest-sized:

Left horn on cranial frag- ment, with burr.	F:A.M.31445	From red layer, Santa Cruz, 1927.
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(Very heavy and lacking in bowing.)

(2) *Meryceros crucensis*, new species

From New Mexico

Dicrocerus necatus LEIDY, referred COPE, 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, p. 353, Pl. LXXXI, Figs. 2, 3, 3a, 5 and 6. 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, p. 33.

Cosoryx necatus LEIDY, referred COPE, 1889, Amer. Nat., XXIII, p. 128, Fig. 18 (1 and 2).

(a) SHAFTS COMPRESSED, FORK WEDGE-SHAPED, POINTS NARROWED

(Specimens somewhat resembling larger section of *Cosoryx*. See *C. ilfonsensis*.)

TALL-SHAFTED

TYPE.—Right horn on cranial fragment, without burr. (Tallest.)	F:A.M.31466	From Santa Cruz, 1927. Collected by Joseph Rak. This paper, Fig. 39A.
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REFERRED.—

Top of cranium and horns.	F:A.M.31444
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[And see specimen of preceding section, F:A.M.31461.]

Without burr

Three from Santa Fé area:

Distal two-thirds of horn.	F:A.M.31441	1927.
Horn.	F:A.M.31467	1925.
Horn on fragment.	F:A.M.31468	1924.

Two from Skull Ridge:

Horn.	F:A.M.31469	1927.
Horn.	F:A.M.31469A	1927.

Top of cranium and horns.	F:A.M.31443	From Santa Cruz, 1925. This paper, Fig. 39A.
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Tall, narrow-waisted, but shorter than F:A.M.31444. With burr. Left horn heavy.

Top of cranium and broken horns.	F:A.M.31458	Below Pojuaque Bluffs, red sand, 1926.
Left horn.	F:A.M.31459	From North Pojuaque Bluffs, 1927.

SHORTER

Top of cranium and horns, with burr.	F:A.M.31472	From Pojuaque Bluffs, 1930. This paper, Fig. 39A.
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Fragment and right horn, without burr.	F:A.M.31475	1925.
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(?)IMMATURE

Right horn on cranial frag- ment, suggestion of burr.	F:A.M.31470	From Skull Ridge, 1927. This paper, <i>Fig. 39A</i> .
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Horn, without burr.	F:A.M.31471	From Santa Cruz, 1927.
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Cope (1877, Pl. LXXXI, Figs. 2 and 3) figures under *Dicrocerus necatus* Leidy, specimens from New Mexico which closely resemble certain specimens listed above (see F:A.M.31475).

(b) SHAFTS SQUAT AND NARROW-WAISTED—M. "WARRENI"-LIKE

MODERATELY LARGE-SIZED

EXAMPLE.—Top of cranium and horns, with burr.	F:A.M.31473	From Santa Cruz, 1928.
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REFERRED.—

Without burr

Pair of horns on cranial frag- ments.	F:A.M.31457	From Skull Ridge, 1927.
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Right horn on cranial frag- ment.	F:A.M.31454	From Santa Cruz, 1928. This paper, <i>Fig. 39</i> .
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(Narrow-waisted.)

Left horn on cranial frag- ment.	F:A.M.31455	From Ojo Caliente, 1931. This paper, <i>Fig. 39</i> .
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Horn on cranial fragment.	F:A.M.31456	From Santa Clara, 1928.
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Top of cranium with horns (twisted).	F:A.M.31453	From Santa Clara, 1931.
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With burr

Right horn on cranial frag- ment.	F:A.M.31462	From Santa Clara, 1928.
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Pair of horns.	F:A.M.31463	From east of Black Mesa, 1927.
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Horn.	F:A.M.31480	From Santa Cruz, 1928.
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Horn.	F:A.M.31481	Between old and new Santa Fé roads, 1926.
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Pair of broken horns.	F:A.M.31482	Below Pojuaque Bluffs, 1926.
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Right horn.	F:A.M.31477	From Santa Cruz, 1928.
(Suggestive of Barstow skull, F:A.M.31163.)		This paper, <i>Fig. 39</i> .

Right horn on cranial fragment, very heavy.	F:A.M.31478	From Santa Cruz, 1928. This paper, <i>Fig. 39</i> .
Left horn on cranial fragment.	F:A.M.31479	From Ojo Caliente, 1929.
Left horn on cranial fragment.	F:A.M.31483	From Santa Fé.
	Without burr	
Right horn. (Might be a small individual of F:A.M.31450.)	F:A.M.31476	From Santa Cruz, 1926.
Right horn on cranial fragment. Large.	F:A.M.31484	From Santa Cruz, 1928. This paper, <i>Fig. 39</i> .
Right horn. Large.	F:A.M.31485	From Santa Cruz, 1928. This paper, <i>Fig. 39</i> .
Pair of horns.	F:A.M.31486	From E. side, N. Pojuaque Bluffs, 1928.
Horn.	F:A.M.31487	From Santa Fé area, 1924.
Left horn.	F:A.M.31488	From Santa Cruz, 1928.
Left horn on cranial fragment.	F:A.M.31489	From Santa Cruz, 1928.
Horn.	F:A.M.31490	From Santa Cruz, 1928.
QUESTIONABLY REFERRED.—		
Top of cranium and broken horns.	F:A.M.31446	From Santa Cruz, upper layer, 1928.
	DIMINUTIVE	
	With burr	
Right horn on cranial fragment.	F:A.M.31491	From Santa Cruz, 1928. This paper, <i>Fig. 39</i> .
Right horn on cranial fragment.	F:A.M.31492	From San Ildefonso, 1929. This paper, <i>Fig. 39</i> .
Left horn.	F:A.M.31493	From Lower Pojuaque Bluffs, 1928.
	Without burr	
Right horn on cranial fragment.	F:A.M.31494	From S.E. White Operation, 1926. This paper, <i>Fig. 39</i> .

(3-4) ***Meryceros nenzelensis***, new species, and ***M. warreni*** (Leidy),
genotypic species

From Cherry County, Nebraska

Meryceros-like horns, while generally less common in the vicinity of the Niobrara River than those of *Cosoryx* form, are known from several localities, including Crookston Bridge, Valentine Quarry A, Fairfield Creek, etc., and unusually heavy-proportioned examples are present from the vicinity of Nenzel. The latter are described as a separate species, and those from the former localities referred to *M. warreni* (Leidy) and varieties. Distinctly smaller-sized horns of questioned *Meryceros* form, typical of the Snake Creek, Sioux County, deposits, are held under *Subparacosoryx*. The Nebraska *Meryceros* horns, as in the case of the specimens from New Mexico, etc., may be conveniently divided according to shape between tall, compressed or short, with spreading points. Certain evidence points to heavy burrs being an accompaniment of increasing age. The available skulls and horns are described in the following pages. Enumeration of the mandibular rami and limb elements is withheld for the general comparative statements, pages 372, 447.

(3) ***Meryceros nenzelensis***, new species

From Nenzel, Cherry County, Nebraska

Figures 40 and (in part) 44

Specimens of much heavier proportions than usual in the remains here referred to *M. warreni* are well represented in a series of skulls and partial skulls, detached horns, rami and limb elements secured by Morris F. Skinner from a deposit in the vicinity of Nenzel. The horns are rather similar to specimens from Santa Cruz, New Mexico, and, as in the case of the latter, include examples of both tall compressed and short flaring shapes. The size of the horns may be moderate (evidently adolescent) to large and may be either burrless or burred. The largest horn happens to be of extremely heavy proportions, the main beam being somewhat short with heavy burr and the points long and bowed. One

partial cranium, with dp^2-m^2 , is particularly interesting in exhibiting the rudimentary horn nubs of the immature male. The metapodials from Nenzel average somewhat larger than those from Crookston Bridge, and while the largest metacarpus is slightly larger than the largest specimen from New Mexico (here referred to *Ramoceros ramosus*), the smallest is considerably larger than the metacarpus of the type of *R. osborni*.

TYPE.—Partial skull with heavy, branching horn without burr. (M+) F:A.M.32174 This paper, *Fig. 40*.
(Best muzzle. Core resembling New Mexican F:A.M.31456.)

REFERRED.—

SHORT, WITH SPREADING POINTS, "WARRENT"-LIKE SHAPE

Heavy burred left horn with short beam and long forks. F:A.M.32186 This paper, *Fig. 40*.
(Largest.)

MORE WEDGE-SHAPED HORN-CORES

Crushed partial skull with tallest horn, burrless, and m^2-m^3 . (M+)	F:A.M.31911	
Skull with p^2-m^2 , burred horn bases, and ramus. (M+)	F:A.M.31902	This paper, <i>Fig. 44</i> (ramus only).
Posterior cranium with tallest main beam, without burr.	F:A.M.32177	This paper, <i>Fig. 40</i> .
Posterior cranium with horns, without burr. (Approximating F:A.M.32174.)	F:A.M.32178	
Posterior cranium with left horn, without burr. (Smaller.)	F:A.M.32179	
Burrless horns (?pair), approximating F:A.M.31911.	F:A.M.31961 and 31963	
Burred horn. (Slender.)	F:A.M.32182	
Partial horn. (Heavier.)	F:A.M.32183	

MODERATE TO SMALL SIZE

Right horn, without burr.	F:A.M.32180	
Right horn, without burr.	F:A.M.32181	
Right horn, without burr. (Smallest.)	F:A.M.31958	This paper, <i>Fig. 40</i> .
Partial horn. (Large.)	F:A.M.32185	
Right horn with tall beam and burr.	F:A.M.31960	This paper, <i>Fig. 40</i> .
Right horn, with burr. (Heavier. Larger than F:A.M.32185.)	F:A.M.32184	

Six fragmental crania:

Posterior portion of immature skull with diminutive pedicle, dp^2 - m^3 (germ). (m) (Smaller size.)	F:A.M.32175	This paper, <i>Fig. 40</i> .
Posterior cranium (fine), horn bases with burrs.	F:A.M.32176	
Top of cranium with horn bases with burrs.	F:A.M.31959	
Three fragments.	F:A.M.31962, 31964A and B	

(See referred rami and maxillæ, Dentition Section III, page 421; and limb elements, Limb Section IV, page 463.)

(4) *Meryceros warreni* (Leidy), 1858, genotypic species

From the Niobrara, Nebraska

Cervus warreni LEIDY, 1858, Proc. Acad. Nat. Sci. Phila., X, p. 23; 1869, Journ. Acad. Nat. Sci. Phila., VII, pp. 172 and 379, Pl. xxvii, Fig. 12.

GENOTYPE.—Right horn-core N.M.149 From Niobrara River.
on cranial fragment, two- (A.M.15596, cast) Figured by Leidy, 1869, Pl.
thirds of anterior prong miss- ["Cotype"] xxvii, Fig. 12.
ing.
Shaft squat, with burr.

The ramal fragment with p_1 - m_3 , tentatively referred to the species by Leidy (1869), who observed that the teeth were the size of *Cervus virginianus*, may have represented a *Dromomerycini*.

(4a) **Meryceros warreni johnsoni**, new subspecies

From Crookston Bridge Quarry, Cherry County, Nebraska

Collected by Johnson, Meade and Associates

Figures 28B, 28C; and (in part) 2, 2A, 28, 35A

The superb series of skulls and other remains from Crookston in the University of Nebraska collection comprises far and away the best series of Merycodontine remains from a single locality. The whole has been placed at the service of the writer by Professor E. H. Barbour. The series includes some seventeen skulls of mature males with teeth and horns, seven having rami attached; two rare skulls of immature males exhibiting a rudimentary "spike-horn" stage; eight skulls of hornless females, three with rami attached, and one of these with associated limb elements, and three skulls of immature females, one with ramus. F. W. Johnson accounts for the beautiful preservation of these specimens through the same having been buried in a layer of fine and largely unconsolidated sand. The remains are definitely smaller than those from Nenzel. The shape of the horns varies much after the manner of the series from other localities between (a) the tall-slender-compressed and (b) the shorter-branching shapes. Interestingly enough, in the present case the horn-cores of the less aged skulls are burrless, the more aged, burred. Four specimens (see three skulls and one detached muzzle) are particularly interesting in confirming the toothless character of the premaxilla, previously shown only in a female from Valentine Quarry A. In several of the crania the C/ alveolus is preserved and in at least two specimens Cs/, of moderate size, are retained. The series illustrates the extreme slenderness of the muzzle and nasals, the peculiar maxillary groove of aged specimens, the lacrimal vacuities, the bullæ, the sutures, the occipital crest, the depression of the inion (strongest in aged specimens), the proportions of the limbs, etc. The condition of the /Is and incisi-formed /C is the same as shown in specimens from Valentine Quarry A and from New Mexico. The dentitions, as seen in the skull specimens and in the large collection of detached mandibular rami, tend to fall within Size Groups III-IV (and ?v), there occurring a moderate difference in the dimensions of teeth and the length of the diastemata, as elsewhere noted. Views of five of the crania are given on Figures 28B, 28C. The material includes:

TYPE.—Complete skull, premaxillæ, C/ alveoli and mandible. (Forks short.).....	(w)	N.S.M. 2-3-8-34
B.L..... = 163 mm.	<i>Figs. 28B, C</i>	
p ¹ -m ³ = 47		
p ₂ -m ₃ = 45.6		
Superior orbit to crotch of horn.... = 57		

REFERRED.—

17 (and type) skulls, or partial skulls, of mature males with teeth and horns, including 7 with rami, 4 with premaxillæ preserved and 3 showing Cs/:

13 (including type) specimens M++ to W++ with (a) shafts tall, slender and forks tending short:

3 (including type) with burrless horns:		N.S.M.
(Type skull—see above).....	(w)	2-3-8-34
	<i>Figs. 28B, C</i>	
Skull, lacking premaxillæ, and mandible. (Posterior tine of right horn fractured ?during life.)..	(M++)	3-3-8-34
Skull with premaxillæ (nasals broken), and mandible.....	(M++)	1-27-7-34

1, horns tallest, with moderate fork (near Valentine Quarry B, N.S.M.20-8-7-33):

Crushed skull, anterior premaxillæ missing.....		2-15-8-34
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4 (aged) with burred horns and shorter forks:

Skull with nasals, premaxillæ missing. (Anterior forks worn.).....	(w+) <i>Figs. 2A, 28C</i>	1-21-8-34
Elongate skull with left premaxilla, Cs/, left maxilla and ramus.....	(w++) <i>Figs. 2, 28B, C</i>	1-23-7-34
Cranial saddle with horns, palate and mandible...	(w++)	8-7-9-34
Skull lacking premaxillæ.....	(w)	1-15-8-35

3 with burred horns and slightly longer forks:

Crushed skull with right horn and base of left, and right maxilla, premaxillæ missing. (Shaft short, 43.5 mm.).....	(w+)	18-17-9-34
Skull with horns, premaxillæ missing.....	(w)	1-15-8-34
Top of skull with right horn.....		16-17-9-34

2 poorly preserved skulls with burrless horns, 1 with the shortest forks:

Crushed skull with partial horns, nasals, left C/, (premaxillæ missing), right and partial left ramus.	(w+)	N.S.M. 4-3-8-34
Crushed skull with horns and mandible. (Shortest forks of Crookston series, tips measuring 41 and 31 mm.).....	(w)	7-7-9-34 <i>Fig. 35A</i>

5 skulls (and 1 horn) w to w+++ of (b) "warreni" shape, shafts tending heavier and with longer tines:

4 with moderately long shafts:

Skull with burrless horns, premaxillæ (crushed) showing left C/.....	(w)	3-5-9-35
Skull with burred horns, premaxillæ missing. (Longest forks, 89 mm.).....	(w+++)	2-5-9-35 <i>Fig. 35A</i>
Partial skull with burred horns and right maxilla...	(w++)	9A-15-8-35
Skull with burrless horns and nasals, premaxillæ missing.....	(w)	3-9-8-34
Detached burred horn, large.....		3-21-8-34

1 with shortest shaft:

Skull with burred horns and nasals, premaxillæ missing. (Shortest shaft, 42 mm.).....	(w)	4-9-8-34
---	-----	----------

8 partial skulls of hornless females, 3 with associated rami (1 with partial limb elements):

Complete skull and mandible with premaxillæ, Cs/ and p ² -m ² , /Is-/Cs and p ₂ -m ₂ . (Large sized.).....	(M+)	2-15-8-35
Skull, premaxillæ missing.....	(w)	6-5-9-35
Skull and mandible.....	(w+)	2-9-8-34 <i>Figs. 28B, C</i>
Skull, ramus and etc. limb elements.....	(M++)	1-3-8-34
Skull.....	(w+)	7-3-8-34
Posterior half of cranium.....		2-21-8-34
Skull with p ² -m ²	(M)	1-17-6-32 <i>Fig. 28</i>
Skull with p ² -m ²	(w)	26-17-6-32

3 immature hornless partial skulls with dp^2-dp^4 and m^1-m^2 :	N.S.M.
Skull.....	3-7-9-34
Skull and proximal two-thirds metacarpus.....	5-9-8-34
Skull and atlas.....	6-7-9-34
4 immature skulls with indication of slight supra-orbital protuberance, dp^2-dp^4 and m^1-m^2 , premaxillæ missing (1 with ramus and limb elements):	
Skull, and ramus with symphysis, /I(erupting) and dp^2-m^2 ; right ulno-radius and metacarpus with distal epiphysis missing.....	10-15-8-35
3 skulls, premaxillæ missing.....	4-5-9-35, 5-5-9-35, 7-15-8-35
3 immature and rudimentarily horned partial skulls with dp^2-dp^4 and m^1-m^2 :	
Skull with horn nubs, and ? femur.....	<i>Fig. 28B</i> 4-7-9-34
Skull with horn nubs.....	<i>Fig. 28B</i> 1-19-9-34
Skull with left rudimentary horn base.....	(-m) 9-7-9-34 <i>Fig. 28B</i>
5 specimens with burrless horns:	
Maxilla and horns.....	(w) 6-3-8-34
Three horn-cores.....	12-7-9-34, 14-17-6-32, 7-27-7-34
Nearly complete skull with fine premaxillæ-maxilla, etc., and horns.....	(w) 5-3-8-34
6 specimens with burred horns:	
Top of cranium with horns.....	3-27-7-34
Two maxillæ with horns.....	(w+) 10-7-9-34
Horns (fragmental).....	11-7-9-34
Partial skull and horns.....	2-7-9-34
Fragmental palate with muzzle, and partial palate..	(w) 2-27-7-34, 5-7-9-34

The following specimens were received too late to be included in this paper: 6 partial skulls with horns, 5 horns, 5 partial skulls of hornless females and 2 immature skulls of hornless females.

(See referred rami, Dentition Section III, page 423; and limbs, Limb Section VI, page 464.)

(4a') Variation

From Valentine Quarries "A" and "B," Cherry County, Nebraska

The University of Nebraska Quarries and other exposures in the vicinity of Valentine have produced several fine crania and numerous rami of Size Groups III^x and IV (Subgroups 1-3). There seems to be little reason for separating the average of these horns and rami from the remains from the Crookston horizon. The main beam of the horns varies from short [as in *M. warreni* type, fine skulls from Snake River (N.S.M. 1-23-7-34), and Fairfield Creek (F.A.M.31276)] to quite tall (N.S.M. 20-8-7-33). The material includes:

Two male and one female skulls:

- | | | |
|---|------------------|---|
| Skull with p ³ -m ³ and burrless horns, largely complete except for the muzzle. (A) | N.S.M.20-8-7-33 | From Railway loc. "B" quarry, on same level as loc. "A" but on west side of tracks and north of ravine. This paper, <i>Figs. 28, 28A.</i> |
| Posterior cranium with left horn base and burr, no teeth. | N.S.M.7-8-16 | |
| Skull, ♀, with p ² -m ³ and muzzle, posterior cranium missing. (M+) | N.S.M.16-16-6-33 | This paper, <i>Fig. 28A.</i> |

Sixteen horn-cores of moderate to smaller size:

- | | |
|---------------------------|---|
| Six with burrs. | N.S.M.5-22-8-30, 5-28-7-30, 11-23-8-30,
23-22-7-31, 21-22-7-31, 15-11-8-30 |
| Three without burrs. | N.S.M.6-17-6-32, 22-22-7-31, 5-7-8-30 |
| Seven partial horn-cores. | N.S.M.3-28-7-30, 50- and 51-12-7-30, 2-15-7-31,
9-1-9-31 |

(See referred rami and maxillæ, Dentition Section III, page 426; and limbs, Limb Section IV, page 466.)

(4a'') Variation

From Fairfield Creek, 45 feet above Brule, Brown County, Nebraska

Horns are taller than *M. warreni* type

- EXAMPLE.—Pair of horns, and ?associated limb fragments and ramus. F:A.M.31276 1930.
This paper, *Fig. 39.*

(See Dentition Section III, page 423; and Limb Section IV, page 466.)

- | | | |
|-------------------|--------------|-------|
| Fragment of horn. | F:A.M.31276A | 1930. |
|-------------------|--------------|-------|

(4b) ***Meryceros warreni*, Var.**

From Dawes County, Nebraska

EXAMPLE.—Right horn-core F:B:A.M.31393 From Quarry E, 1935.
 with anterior fork missing.
 (Not included in specimen count.)

(5) ***Meryceros warreni*, Var. or Subspecies**

From Pawnee Creek, Colorado

(Only very slightly larger than the smallest New Mexican, F:A.M.31491.)

EXAMPLE.—Both horns.	F:A.M.31319	From east of camp, 1931. This paper, <i>Fig. 39</i> .
Fragment of horn.	F:A.M.31319A	From Mastodon Quarry, 1931.
Right horn.	F:A.M.31295	From Horse Quarry, 1933.
Horn.	F:A.M.31295A	From east of camp, 1931.

(6) ***Meryceros joraki*, new species**

From Barstow, California

Merycodus necatus? LEIDY, MERRIAM, 1919, Univ. Cal. Pub. Bull. Dept. Geol., XI,
 p. 517, Figs. 113–117 and 133–134.

Merycodus necatus LEIDY, FURLONG, 1927, *ibid.*, XVII, p. 147, Pls. xxiv, xxv.

Merycodontine horns are rare in the Barstow deposits. Until recently, *Meryceros* has been but sparsely represented. Eustace L. Furlong (1927) describes and figures a cranium with characteristic horns (and mandible and fore and hind limb bones—U.C.26781) under *Merycodus necatus*. John C. Merriam (1919) figures from Barstow, under *Merycodus* species, a posterior cranium with horn-core bases, and, under *Merycodus necatus*? Leidy, other horn-cores [also several partial rami and detached teeth (Figs. 126–131)]. All of these specimens seem to fall within the moderate-shafted, compressed and wedge-shaped horn-core section of the present report. Since the preceding pages were sent to the press, we have received a collection of partial crania with horns, detached horns and partial upper and lower dentitions from two new localities in the upper layers of the First Division (Leader and Hidden Quarries). The horns exhibit about the same size range as previously

known specimens. The posterior tines are notably abbreviated relative to the anterior tines. A single specimen (F:A.M.32810) has the two tines separately burred, much as in the considerably smaller *Submeryceros crucianus* [see (8) below]. The specimen is interpreted doubtfully as a young individual of the general Leader Quarry series—see Figure 35 of the latter, compared to intermediate-sized and heavily burred F:A.M.32822, and unusually large and lightly burred F:A.M.32811 (Fig. 35A) from the same locality. Cranium F:A.M.31850 is provided with unusually large-sized molars (Size Group II). The horns, or more correctly horn-cores, are listed below.

TYPE.—Major portion of cranium with cheek teeth and right horn. (w)	F:A.M.31163	From Hemicyon Stratum, 1926.
(See Dentition Section III, page 439.)		This paper, Figs. 28, 28A.

REFERRED.—

LARGE INDIVIDUALS

Right horn with fragment of burr.	F:A.M.31165	From North End, 1930.
Broken horn. (Specimen possibly suggesting <i>P. alticornis</i> .)	F:A.M.31155	From Hemicyon Stratum, 1926.

MORE MODERATE-SIZED

Right horn (burrless) on cranial fragment, and ?associated distal end of humerus.	F:A.M.31156	From an indefinite horizon, 1926.
Left horn, with burr.	F:A.M.31157	From Valley View, 1933.

MODERATE-SIZED

Right horn with burr.	F:A.M.31158	From Hemicyon Stratum, ?"Old Mill," 1931.
Left horn with burr.	F:A.M.31167	From Old Mill, 1931.
(Type—see above.)	F:A.M.31163	Hemicyon Stratum, 1926. This paper, Figs. 28, 28A.
Horn (burrless) and ?associated toothless ramus.	F:A.M.31160	From White Operation, 1927.
Partial left horn.	F:A.M.31164	From North End, 1930. This paper, Fig. 39.
Horn, burr showing.	F:A.M.31168	From White Layer, $\frac{1}{2}$ mi. above cabin, 1926.
Horn with burr. Taller, forks arched.	F:A.M.31169	From bottom layer, 1923.

Right horn and possibly associated ramal fragment. F:A.M.31162 From Second Division, 1927. This paper, *Fig. 39*.

(Dark-colored.) The shaft is short with heavy burr and fork points wide spreading. (See Dentition Section III, page 442.)

Fragment of horn. F:A.M.31155A Hemicyon Stratum, 1927.

Fragment of horn. F:A.M.31166 From North End, 1932.
(Small.)

IMMATURE (SMALL-DIMINUTIVE)

Left horn, without burr. F:A.M.31161 Hemicyon Stratum, 1926.

ADDITIONAL SPECIMENS SECURED BY JACK WILSON PARTY OF 1934-35.—

Thirty-three horn-cores from Leader Quarry:

Large:	F:A.M.
Left crushed horn on cranial fragment, with burr.....	<i>Fig. 35A</i> 32811
Right horn-core.....	32812
Posterior portion of cranium with both horn-cores (br.) with burrs.	32813
Two horn-cores, one with burr.....	32814,A
Two pairs of broken horn-cores.....	32815,A
Pair of horn-cores on partial cranium, with burrs.....	32816
Partial horn-core with very heavy burr.....	32817
Two partial horn-cores, second with burr.....	32817A,B
Horn-core on cranial fragment, without burr.....	32818
Pair of horn-cores on cranial fragment, with burr.....	32819

Thirteen horn-cores of more moderate size:

Three horn-cores with burrs.....	32820,A,D
Three horn-cores, without burr.....	32820B,C,F
Pair of horn-cores with burrs.....	32820E
Six horn-cores, two with burrs.....	32820G-L

Sub-moderate-sized:

Three horn-cores with burrs.....	32821,A,B
----------------------------------	-----------

Variations of form exemplified by:

Peculiar horn-core with short base and extremely developed burr	<i>Fig. 35A</i> 32822
Three horn-cores with tips less divergent, two with burrs.....	32823,A,B
Left horn-core with separately burred tines—size small. <i>Fig. 35</i>	32810

Three from Hidden Hollow Quarry:

Posterior two-thirds portion of cranium with both horn-cores with burrs, and m ¹ -m ²	31850
Posterior portion of cranium with more slender horn-cores with burrs.	31851
Partial horn-core with burr.....	31852

(See referred rami and maxillæ, Dentition Section III, pages 438-441, 443; and questionably referred limbs, Limb Section IV, page 466.)

(7) *Meryceros hookwayi* (Furlong)

From the Vicinity of Tonopah, Nevada

Merycodus hookwayi FURLONG, 1935, Carn. Inst. Wash. Pub. 453, p. 6, Pl. v.TYPE.—Right p_2-m_3 (m_1 represented by roots).

C.I.T.1257

Figured by Furlong, 1935, Pl. v, Figs. 3, a-b.

REFERRED AND FIGURED BY FURLONG.—

Frontlet with burred
horn-cores.

C.I.T.1240

Pl. v, Figs. 1 and 1a.

(See Dentition Section III, page 445.)

IIIA. SUBMERYCEROS, NEW SUBGENUS

(8) *M. (Submeryceros) crucianus*, new subgenus and species

From Santa Cruz, New Mexico

Dicrocerus necatus LEIDY, referred COPE, 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, p. 353, Pl. LXXXI, Fig. 4. 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, p. 33.

The specimen figured by Cope (Pl. LXXXI, Fig. 4) under *D. necatus*, while slightly larger, in the presence of a separate burr on the base of each prong of the fork, closely resembles our specimens. [A maxilla of the same individual is figured by Cope (Pl. LXXXII, Fig. 3) and an m_3 (Fig. 4)].

Separate burr at base of each prong

SUBGENOTYPE.—Left horn.

F:A.M.31495

This paper, Fig. 35.

REFERRED.—

Left horn.

F:A.M.31496

This paper, Fig. 35.

Right horn on cranial fragment.

F:A.M.31497

This paper, Fig. 35.

Horn.

F:A.M.31498

To the subgenus are questionably allotted a number of Size Group

VI—VII partial mandibular rami which have been placed (see Dentition Section III, pages 403, 433, 407, 404) in four species and subspecies:

- (9) (?) *S. minor*, n.sp., from New Mexico.
 - (9a) (?) *S. minor serpentinus*, n.subsp., from Snake Creek, Nebraska.
 - (9b) (?) *S. minor pawniensis*, n.subsp., from Pawnee Creek, Colorado.
 - (10) (?) *S. minimus*, n.sp., from New Mexico.
-

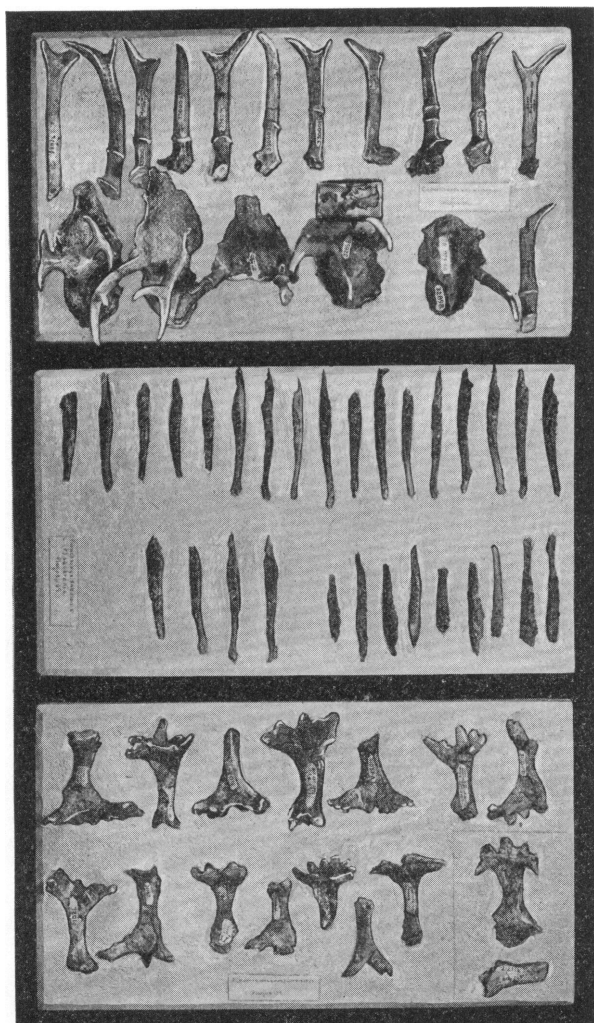


FIG. 40A. Method of filing the fossil data, exemplified by three plaster plaques holding Sioux County, Nebraska, *Paracosoryx* and Barstow, California, *Merriamoceros* specimens.

SECTION III.—MERYCODONTINI DENTITIONS AND MANDIBULAR RAMI

Figures 41–47A and (in part) 28B, 35A, 37, 37A, 38;
Maxillary Dentitions (in part) 26, 28A–C, 37, 37A, 40

Statement

(See Merycodontini Discussion)

One thousand and ninety-five here listed and some two thousand one hundred and eleven unlisted and more or less fragmentary Merycodontini mandibular or maxillary dentitions have been available for study. The near Antilocaprine form of the Merycodontine dentition has been remarked in the preceding discussion, Section I, page 313. At this point there were briefly discussed: variations in size, in elongation of the post-/C diastema, interproportions of premolars and molars and height of tooth crowns; also the imperfect condition of many important specimens, the tooth changes that occur with wear and the several perplexing questions as to named species (including the genotypic *M. necatus* Leidy) where the types have been rami unassociated with horns.

The unusual wealth of evidence immediately suggests an alluring field for investigation of the degree to which distinct but closely allied forms (having an indeterminate range of individual variation and percentage of abnormality) may be recognized on mandibular and dental characters alone. The apparent insufficiency of this unusually complete evidence calls attention to the danger of attempting to decipher too minutely the relatively meager evidence alone available in the case of the great majority of extinct mammalian groups. Leidy little suspected the ramifications of the Merycodontini when in 1854 he described, on the basis of the then available mandibular fragments, "*Merycodus necatus* . . . a small ruminant allied to the Musks." The detailed lists (pp. 391–445) illustrate the relative abundance of remains of Size Groups III and IV, and at the same time the rarity of Size Groups V to VII. As observed above, since it is impossible as yet definitely to characterize the dentitions or limbs of the three groups based on the horns—*Ramoceros*, *Cosoryx* and *Meryceros*—there continues to be a lack of definiteness of reference, in the case of many of the detached ramal and maxillary dentitions and limb elements, to species based on the horns. The frequency of occurrence of the horns of several genera and subgenera in certain localities is presumptive of the probability of the same genera being propor-

tionately well represented in the dentitions. The measurements and percentages in the case of representative mandibles are given in the seven-paged table and a considerable number of such examples are comparatively illustrated [Figs. 41–47A and (in part) 28B, 35A, 37, 37A, 38]. The available mandibles and dentitions, for present and future ease of reference, are considered according to area of occurrence. *Cosoryx* and *Meryceros* are best seen in the very remarkably preserved mandibles from several Nebraska localities, and the respective characters of these genera are discussed in some detail in connection with associated remains from the Midway and Crookston Quarries. *Subcosoryx* is illustrated in a fine series from New Mexico. *Ramoceros*, so well represented in the horns from New Mexico, is but doubtfully identified among the mandibular rami from the same area. The amassed data in regard to the dentitions, according to the above-explained plan of the report, are recorded under the six major geographical divisions:

- (1) NEW MEXICO—including *Ramoceros*, *Paramoceros*, *Cosoryx*, *Subcosoryx*, *Meryceros* and *Submeryceros*, pages 391–405.
- (2) COLORADO—including *Ramoceros*, *Cosoryx*, [*Meryceros*] and *Submeryceros*, pages 406–407.
- (3A) SOUTH DAKOTA, (3B) KANSAS AND (3C) MONTANA—with *Paramoceros* and *Cosoryx*, pages 408–409, 410, 411.
- (4) NEBRASKA—
Brown and Cherry Counties, including *Paramoceros*, *Cosoryx* and *Meryceros*, pages 412–427, and
Sioux, Dawes and Hitchcock Counties, with *Ramoceros*, *Cosoryx*, *Paracosoryx*, *Subparacosoryx* and *Submeryceros*, pages 428–434.
- (5) CALIFORNIA—
Barstow, including *Paracosoryx*, *Merriamoceros* and *Meryceros*, pages 435–443, and
Ricardo, with *Paracosoryx*, page 444.
- (6) NEVADA AND OREGON—*Paracosoryx* and *Meryceros*, rare, page 445.

The adjacent series of comparative figures present certain of the more typical mandibular rami arranged according to area. These figures are followed by seven pages of measurements and percentages of outstanding examples (Table VIII).

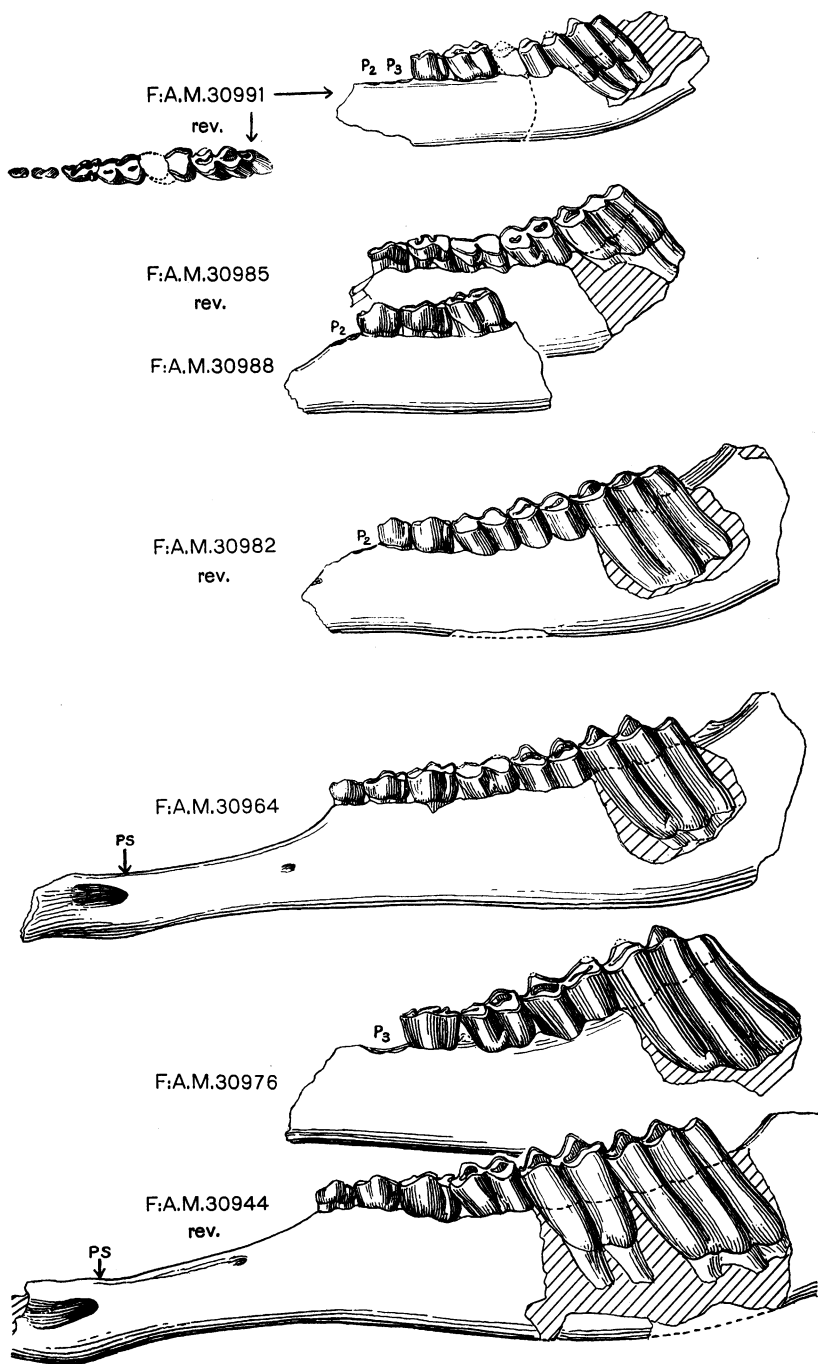


FIG. 41. Examples of Merycodontini mandibular dentitions from the Late Tertiary of New Mexico, lateral views (and one occlusal) compared.

× 1. (See legend, page 377.)

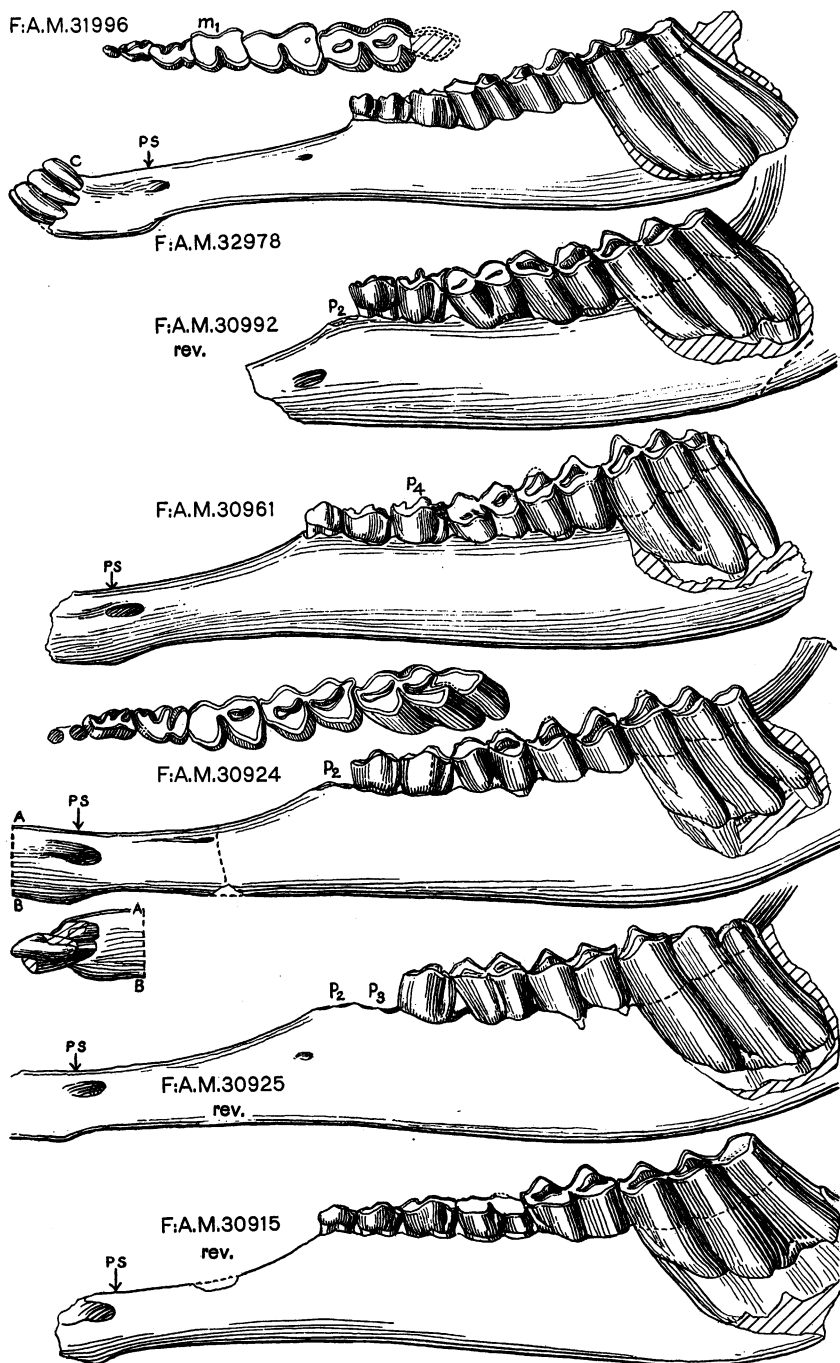


FIG. 42. Examples of Merycodontini mandibular dentitions from the Late Tertiary of New Mexico, lateral views (and two occlusal) compared.

× 1. (See legend, page 377.)

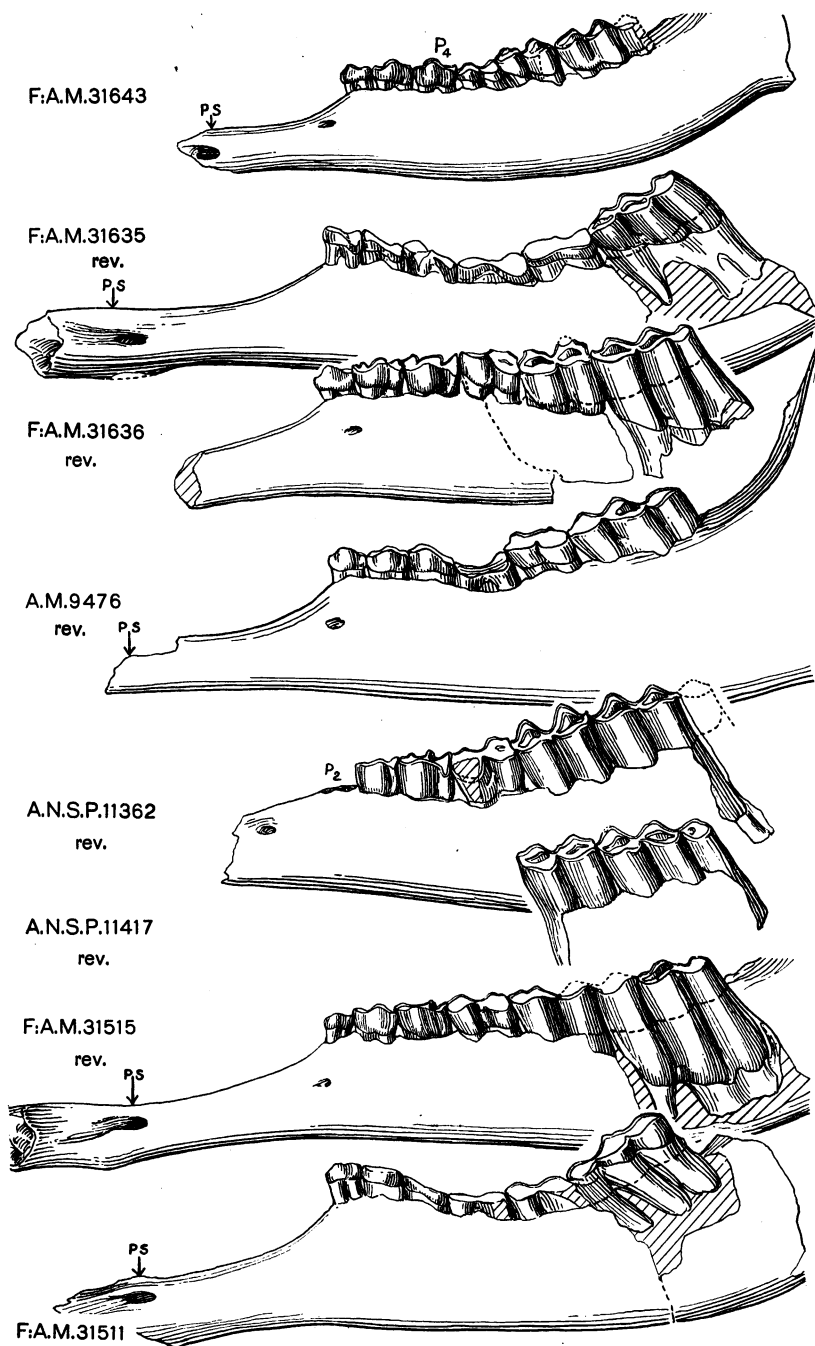


FIG. 43. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Colorado (F:A.M.31643, 31635, 31636 and A.M.9476), South Dakota (A.N.S.P.11362 and 11417) and Kansas (F:A.M.31515 and 31511), lateral views compared.

× 1. (See legend, next page.)
376

FIGS. 41 AND 42. Examples of Merycodontini mandibular dentitions from the Late Tertiary of New Mexico, lateral views (and three occlusal) compared.

× 1. PS, posterior border symphysis.

FIG. 41. F:A.M.30991, (?)*Submeryceros minimus*, n.sp., type, rev., from Cuyamungue.

(See Size Group VII, page 404.)

F:A.M.30985, ref., rev., and 30988, type, of (?)*Submeryceros minor*, n.sp., from Cuyamungue and Tesuque, respectively.

(See Size Group VI, page 403.)

F:A.M.30982, *C. (Subcosoryx) cerroensis*, n.subg. and sp., ref., rev., from Pojuaque Bluffs.

(See Size Group V, page 396.)

F:A.M.30964, 30976 and 30944, *Ramoceros*, *Cosoryx* or *Meryceros* species, from Santa Cruz, San Ildefonso and Pojuaque Bluffs, respectively.

(See Size Groups IV and III, pages 402, 401.)

FIG. 42. F:A.M.31996 and 32978, *C. (Subcosoryx) cerroensis*, n.subg. and sp., ref. and subgenotype, from Round Mountain Quarry.

(See also Fig. 38 [F:A.M.31996] and Size Groups III, V, pages 393, 392.)

F:A.M.30992 (rev.), 30961, 30924, 30925 (rev.) and 30915 (rev.), *Ramoceros*, *Cosoryx* or *Meryceros* species, from Skull Ridge (30992), Santa Clara (30924) and Santa Cruz.

(See Size Groups II*, IIA and II, pages 400, 398, 397.)

FIG. 43. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Colorado, South Dakota and Kansas, lateral views compared.

× 1. PS, posterior border symphysis.

F:A.M.31643, (?)*Submeryceros minor pawniensis*, n.subsp., type, from Pawnee Creek, Colorado.

(See Size Group VI, page 407.)

A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), rev., and F:A.M. 31635 and 31636, rev., from Pawnee Creek, Colorado.

(See also Figs. 28, 28A [cranium of A.M.9476] and Size Group III, page 406.)

A.N.S.P.11362 and 11417, *Cosoryx furcatus*, var. or subsp., rev., from Little White River and Sweetwater, South Dakota, respectively.

(See Size Group III, page 408.)

F:A.M.31515, *Cosoryx furcatus*, var., rev., from Republican River Beds, Kansas.

(See Size Group III, page 410.)

F:A.M.31511, *Cosoryx furcatus sternbergi*, n.subsp., type (in part), from Kansas.

(See also Figs. 28, 28A, 36, 36A [cranium and horns] and Size Group III, page 410.)

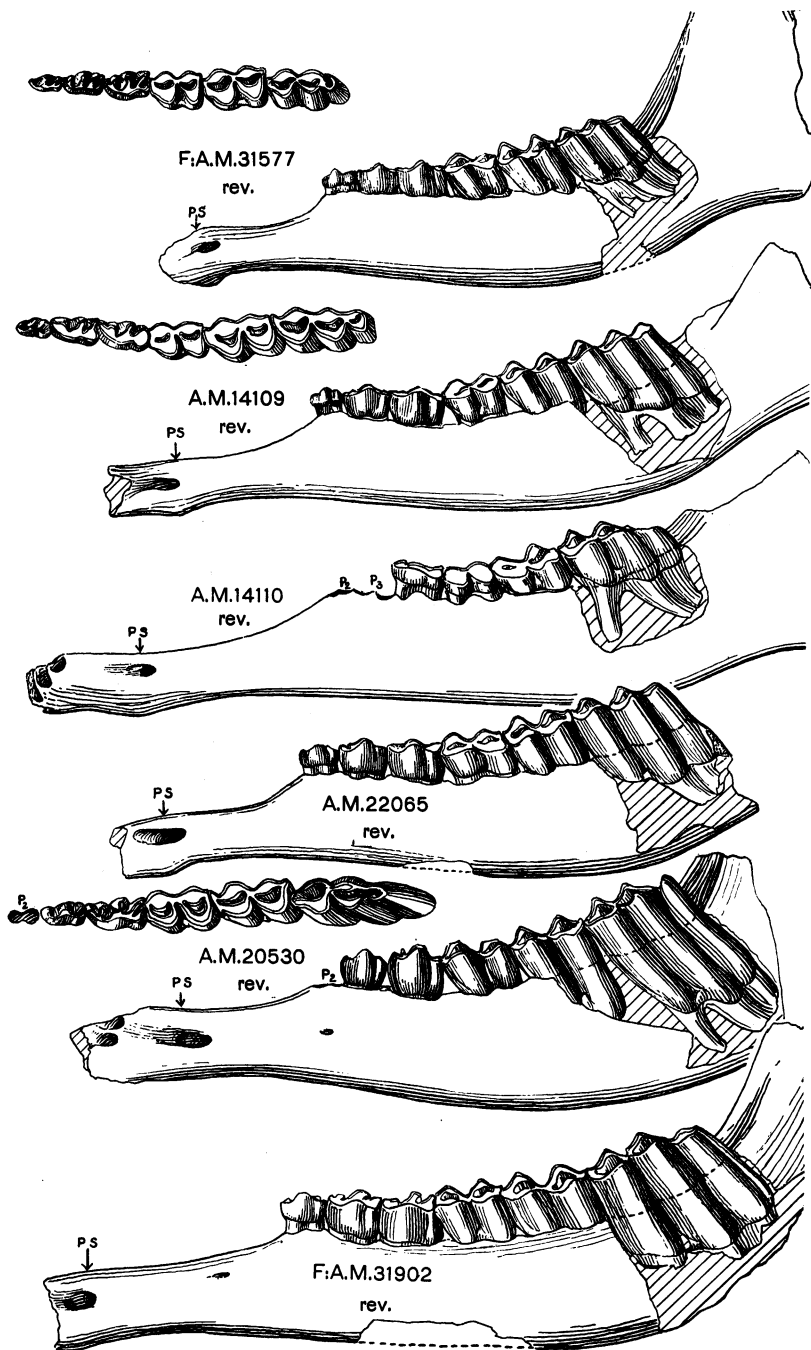


FIG. 44. *Submeryceros*, n.subg. (F:A.M.31577), *Paracosoryx*, n.subg. (A.M.14109, 14110, 22065 and 20530) and *Meryceros*, n.g. (F:A.M.31902), examples of mandibular dentitions from the Late Tertiary of Nebraska, lateral (and three occlusal) views compared.

× 1. (See legend, page 382.)

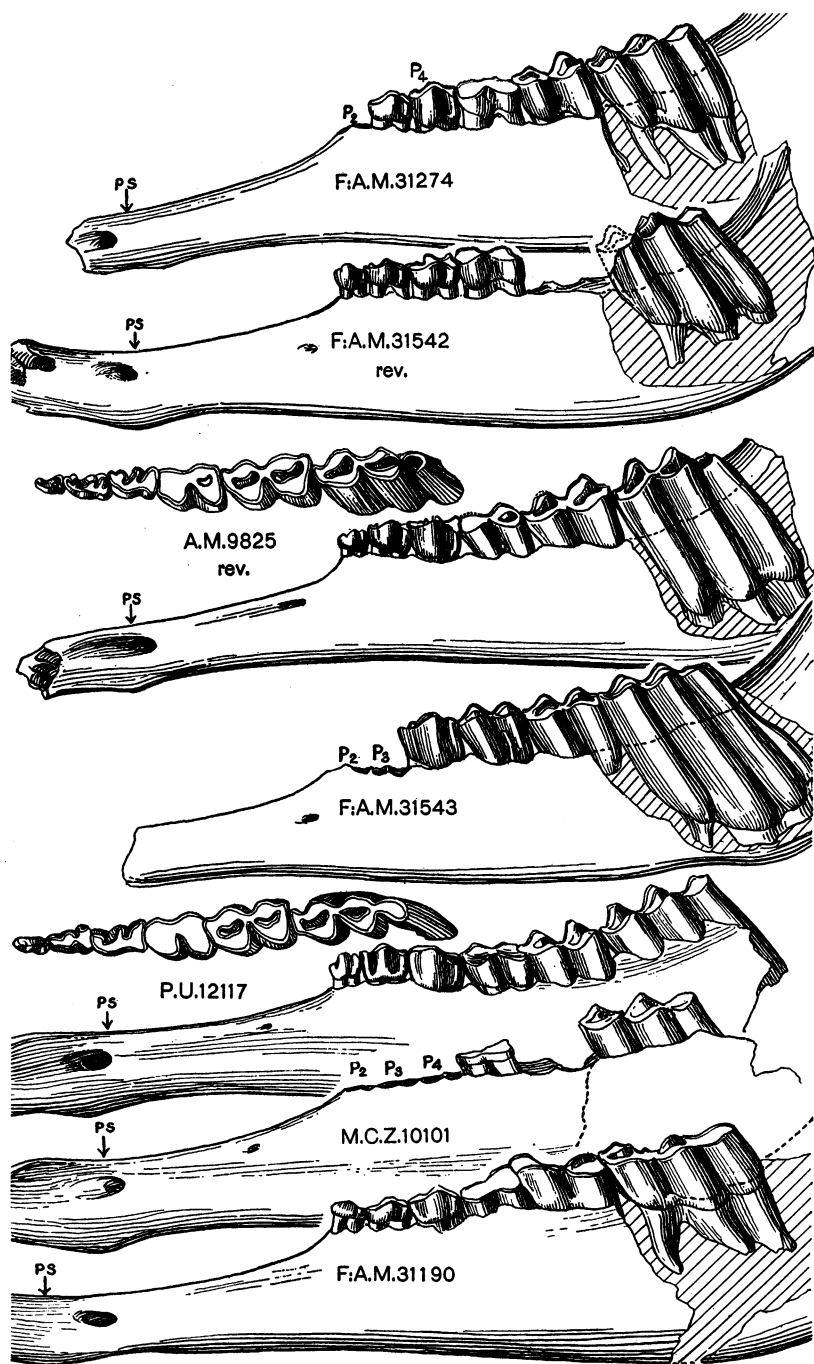


FIG. 45. *Cosoryx* Leidy, (?) *Meryceros*, n.g. (F:A.M.31542) and (?) *Plioceros*, n.g., ref. (F:A.M.31190 and 31543), examples of mandibular dentitions from the Late Tertiary of Nebraska (and South Dakota [A.M.9825]), lateral (and two occlusal) views compared.

× 1. (See legend, page 382.)

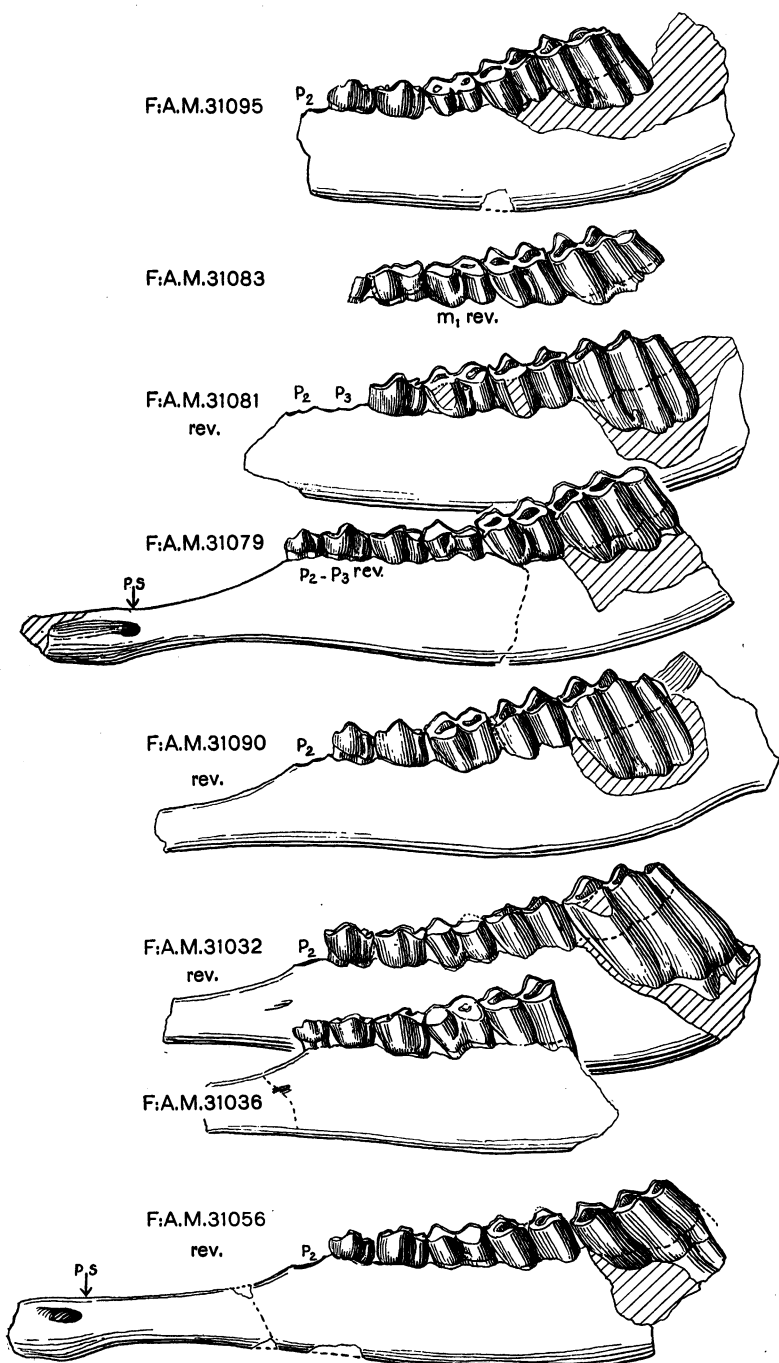


FIG. 46. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Barstow, California, lateral views compared.

× 1. (See legend, page 383.)

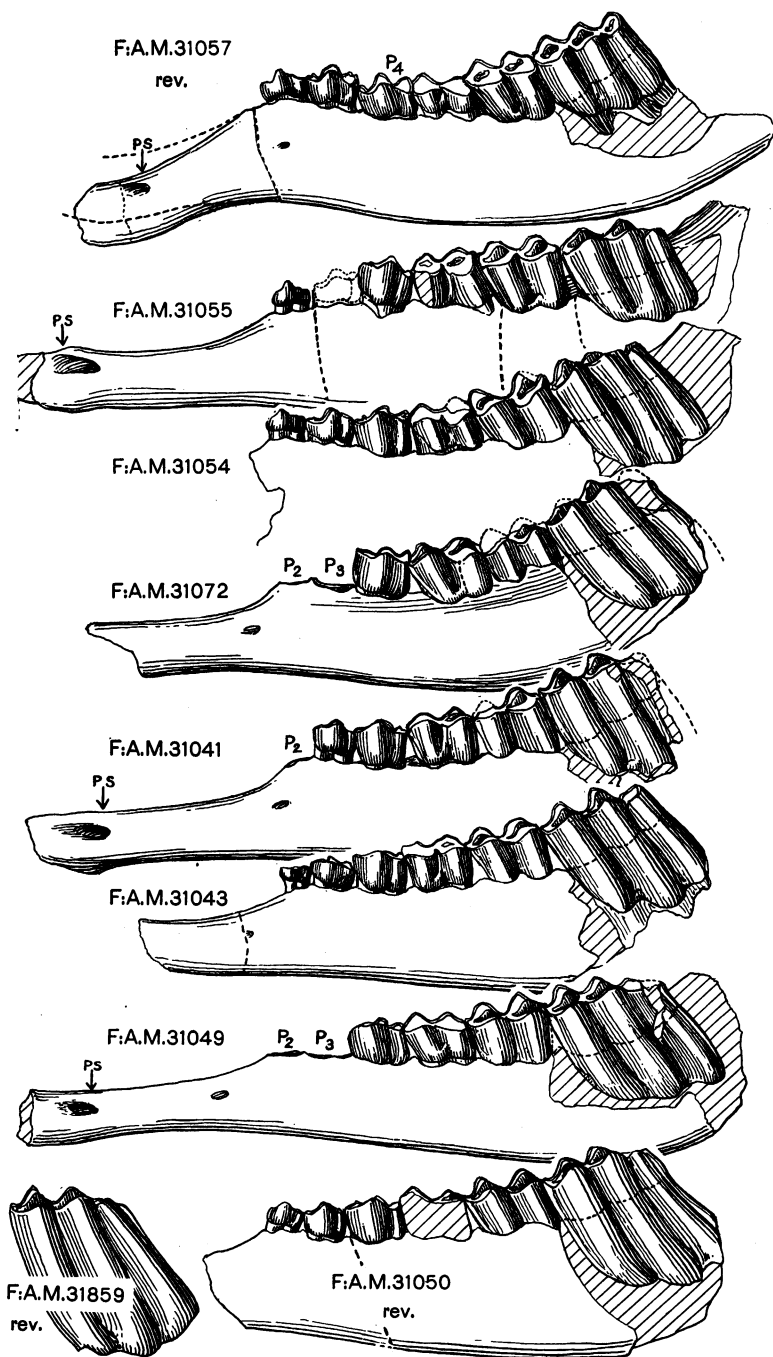


FIG. 47. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Barstow and Ricardo (F.A.M.31859), California, lateral views compared. $\times 1$. (See legend, page 383.)

FIGS. 44 AND 45. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Nebraska (and South Dakota [A.M.9825]), lateral (and five occlusal) views compared.

× 1. PS, posterior border symphysis.

FIG. 44. F:A.M.31577, (?) *Submeryceros minor serpentinus*, n.subsp., type, rev., from East Sinclair Draw, Sioux County, Nebraska.

(See Size Group VI, page 433.)

A.M.14109, *Paracosoryx sabulonis* (Matthew and Cook), type, rev., from Sioux County, Nebraska.

(See Size Group IVB, pages 353, 431.)

A.M.14110, 22065 and 20530, *Paracosoryx sabulonis* (Matthew and Cook), or *P. savaronis*, n.sp., ref., rev., from Sioux County, Nebraska.

(See Size Groups III-IV, Vars. A, B and A, respectively, pages 430, 431.)

F:A.M.31902, *Meryceros nenzelensis*, n.sp., ref., rev., from Nenzel, Cherry County, Nebraska.

(See Size Group II, page 421.)

FIG. 45. F:A.M.31274, (?) *Cosoryx furcatus* Leidy, ref., from Moore Creek, Brown County, Nebraska.

(See Size Group III, page 419.)

F:A.M.31542, (?) *Meryceros* var., rev., from above Devil's Gulch, Brown County, Nebraska.

(See Size Group III, page 422.)

A.M.9825, *Cosoryx furcatus*, var. or subsp., rev., from Little White River, South Dakota.

(See Size Group III, page 408.)

F:A.M.31543, *Plioceros floblairi*, n.sp., ref., from J. Wilson Ranch, Brown County, Nebraska.

(See Size Group III, page 496.)

P.U.12117, *Cosoryx furcatus* Leidy, large var., from Sioux County, Nebraska.

(See Size Group IIIA, page 429.)

M.C.Z.10101, *Cosoryx furcatus* Leidy, ref. Scott, large var., from Garman Loup Fork Collection, Nebraska.

(See Size Group III², pages 418, 429.)

F:A.M.31190, *Plioceros floblairi*, n.sp., ref., from Fairfield Falls Quarry, Brown County, Nebraska.

(See Size Group III, page 496.)

FIGS. 46 AND 47. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Barstow and Ricardo (F:A.M.31859), California, lateral views compared.

× 1. PS, posterior border symphysis.

FIG. 46. *Meryceros joraki*, n.sp., ref.

F:A.M.31095, from Third Division.

(See Size Group V, page 443.)

F:A.M.31083 (m₁ rev.), from Fourth Division.

(See Size Group IVD, page 442.)

F:A.M.31081, rev., from Third Division.

(See Size Group IVC, page 442.)

F:A.M.31079 (p₂-p₃ rev.), from Second Division.

(See Size Group IVB, page 442.)

F:A.M.31090, rev., from Valley View Quarry.

(See Size Group IVA, page 441.)

F:A.M.31032 (rev.) and 31036, from North End.

(See Size Groups IV and IIIC, page 439.)

F:A.M.31056, var., rev., from the Green Hills.

(See Size Group IIIF, page 441.)

FIG. 47. F:A.M.31057 (rev.) and 31055, *Meryceros joraki*, var., from Green Hills.

(See Size Group IIIF, page 441.)

F:A.M.31054 and 31072, *Meryceros joraki*, n.sp., ref., from Hemicyon Stratum.

(See Size Group IIIB, page 438.)

F:A.M.31041 and 31043, *C. (Paracosoryx) alticornis*, n.sp., ref., from Skyline Quarry.

(See Size Group IIIA, page 437.)

F:A.M.31049 and 31050 (rev.), *Meryceros joraki*, n.sp., ref., from White Operation.

(See Size Group IIID, page 439.)

F:A.M.31859, *C. (Paracosoryx) furlongi*, n.sp., ref., rev., from Ricardo Pliocene.

(See Size Group III, page 444.)

TABLE VIII
MERYCODONTINI MANIBLES
COMPARATIVE MEASUREMENTS AND RATIOS
[Millimeters]

	Locality	Size Group	Page	Collection No.	Tooth Wear	$\frac{m_3}{PS d.}$	$\frac{p_3-p_4}{m_1-m_3}$	$\frac{p_2}{p_4}$	$\frac{p_2}{m_3}$	$\frac{p_3}{p_4}$	$\frac{p_3}{m_3}$	See Fig.
<i>Ramoceros, Cosoryx</i> or <i>Meryceros</i> species.....	New Mexico St. Cruz	II	397	F.A.M. 30915	W	$\frac{19.}{28.} = 68\%$	$\frac{19.}{38.8} = 50\%$	$\frac{5.2}{7.8} = 67\%$	27%	$\frac{6.4}{7.8} = 82\%$	34%	42
"	"	"	398	30925	A	$\frac{19.5}{30.} = 65$	$\frac{((18.5))}{41.} = ((45))$	$\frac{7.5}{7.5}$				42
"	St. Clara	"	"	30924	M	$\frac{17.}{31.} = 55$	$\frac{((19.))}{39.3} = ((48))$	$\frac{7.2}{7.2}$		$\frac{7.}{7.} = 97$	41	42
"	St. Cruz	"	"	30961	M+	$\frac{16.5}{25.5} = 65$	$\frac{18.}{38.} = 47$	$\frac{5.}{7.7} = 65$	30	$\frac{6.3}{7.7} = 82$	39	42
<i>Meryceros nenzelensis</i> , ref.....	Nebraska Cherry Co., Nenzel	"	421	31902	M++	$\frac{16.6}{26.} = 64$	$\frac{21.4}{36.} = 59$	$\frac{6.}{7.7} = 78$	36	$\frac{7.2}{7.7} = 94$	43	44
<i>R. (Paramoceros) tansanus</i> , ref....	Kansas	II-410	410	31512	W+	$\frac{17.3}{17.3}$	$\frac{33.4}{33.4}$	$\frac{7.3}{7.3}$		$\frac{6.}{7.3} = 82$	35	
<i>Ramoceros, Cosoryx</i> or <i>Meryceros</i> species.....	New Mexico Pojuaque Bluffs	III	401	30944	M	$\frac{14.5}{28.} = 52$	$\frac{17.8}{34.} = 52$	$\frac{4.8}{7.5} = 64$	33	$\frac{6.}{7.5} = 80$	41	41
"	Skull Ridge	"	"	30945	M+	$\frac{(16.)}{28.} = (57)$	$\frac{(16.6)}{(34.6)} = (48)$	$\frac{4.5}{6.8} = 66$	(28)	$\frac{6.}{6.8} = 90$	(38)	
"	San Ildefonso (No sign of p.)	"	"	30976	M	$\frac{15.4}{15.4}$	$\frac{35.5}{35.5}$	$\frac{8.5}{8.5}$				41

<i>Ramoceros osborni</i> , genotype (part).....	III	406	A.M. 9476	w++	$\frac{(16.3)}{(26.)} = (63)$	$\frac{(16.3)}{(31.)}$	= (53)	$\frac{(5.)}{(6.3)}$	= (79)	(31)	$\frac{(5.5)}{(6.3)}$	= (87)	(34)	43
<i>Ramoceros, Cosoryx</i> or <i>Meryceros</i> species.....	"	"	F.A.M. 31635	w+	$\frac{(15.)}{26.} = (58)$	$\frac{(18.)}{(31.5)}$	= (57)							43
"	"	"	31636	w	$\frac{14.}{13.5}$	$\frac{19.}{(33.)}$	= (58)	$\frac{5.2}{7.4}$	= 70	37	$\frac{6.9}{7.4}$	= 93	49	43
"	"	407	31637	m	$\frac{13.5}{(18.5)}$	$\frac{(18.5)}{(34.)}$	= ((54))	$\frac{7.3}{7.3}$			$\frac{7.}{7.3}$	= 96	52	
<i>Cosoryx f. sternbergi</i> , type (part)...	"	410	31511	w+	$\frac{(15.5)}{(26.4)} = (59)$	$\frac{(16.)}{(30.2)}$	= (53)	$\frac{(5.)}{(6.4)}$	= (78)	(32)	$\frac{(5.8)}{(6.4)}$	= (90)	(37)	43
<i>C. furcatus</i> , var.....	"	"	31515	m+	$\frac{16.}{25.5} = 63$	$\frac{16.}{35.5}$	= 45	$\frac{3.8}{7.4}$	= 51	24	$\frac{6.3}{7.4}$	= 85	39	43
<i>C. f. mooki</i> , type (part).....	"	411	A.M. 21370	w	$\frac{17.}{15.5}$	$\frac{15.5}{34.5}$	= 45	$\frac{4.3}{6.2}$	= 69	25	$\frac{5.6}{6.2}$	= 90	33	
<i>C. furcatus</i> , var. or subsp., ref....	"	408	9825	m	$\frac{15.5}{28.4} = 55$	$\frac{16.}{36.}$	= 44	$\frac{3.9}{6.9}$	= 57	25	$\frac{6.}{6.9}$	= 87	39	45
(?) <i>Meryceros</i> , var.....	"	423	8561	w+	$\frac{16.8}{26.} = 65$	$\frac{18.}{33.}$	= 55	$\frac{5.4}{7.}$	= 77	32	$\frac{6.5}{7.}$	= 93	39	
<i>C. furcatus</i> , large var.....	"	429	P.U. 12117	m+	$\frac{16.3}{30.} = 54$	$\frac{17.}{35.4}$	= 48	$\frac{4.6}{7.2}$	= 64	28	$\frac{6.3}{7.2}$	= 88	39	45
<i>C. furcatus</i> , ref.....	"	419	F.A.M. 31274	w	$\frac{15.2}{29.} = 52$	$\frac{(16.5)}{32.}$	= ((52))	$\frac{7.}{7.}$			$\frac{5.5}{7.}$	= 79	36	45

(Continued on next page)

TABLE VIII—Continued

Locality	Size Group	Page	Collection No.	Tooth Wear	$\frac{m_3}{PS d.}$	$\frac{p_2-p_4}{m_1-m_3}$	$\frac{p_2}{p_4}$	$\frac{p_2}{m_3}$	$\frac{p_2}{p_4}$	$\frac{p_3}{m_3}$	See Fig.
<i>C. (Paracosoryx) wilsoni</i> , ref.....	III	430	F.A.M. 32007	M	$\frac{14.5}{18.} = 81\%$	$\frac{20.}{35.} = 57\%$	$\frac{5.}{8.} = 63\%$	34%	$\frac{7.}{8.} = 88\%$	48% 37	
"	"	429	32005	M	$\frac{14.}{18.} = 78$	$\frac{18.}{34.} = 53$	$\frac{4.4}{7.6} = 58$	31	$\frac{6.3}{7.6} = 83$	45	
<i>C. (P.) sabulonis</i> or <i>C. (S.) savanensis</i> , ref., A var.....	"	431	A.M. 20530	M	$\frac{14.}{17.} = 82$	$\frac{((17.5))}{32.5} = ((54))$	$\frac{7.5}{7.5}$		$\frac{6.3}{7.5} = 84$	45 44	
"	IV	"	26887	W	$\frac{14.4}{14.4}$	$\frac{20.}{32.} = 63$	$\frac{5.6}{7.5} = 75$	39	$\frac{7.}{7.5} = 93$	49	
" B var.....	"	432	22740	A	$\frac{14.5}{18.} = 80$	$\frac{((19.))}{33.} = ((58))$	$\frac{8.5}{8.5}$		$\frac{7.}{8.5} = 82$	48	
<i>C. (P.) alticornis</i> , ref.....	III	437	F.A.M. 31040	M+	$\frac{16.5}{24.} = 69$	$\frac{((17.))}{35.5} = ((48))$	$\frac{7.3}{7.3}$		$\frac{6.3}{7.3} = 86$	38	
"	"	"	31041	M	$\frac{(16.)}{(25.)} = (64)$	$\frac{(17.)}{(33.5)} = (51)$	$\frac{7.2}{7.2}$		$\frac{5.8}{7.2} = 81$	(36) 47	
"	"	"	31043	M+	$\frac{14.3}{14.3}$	$\frac{17.}{33.} = 52$	$\frac{4.5}{7.} = 64$	31	$\frac{6.}{7.} = 86$	42 47	
" var., ref.....	"	438	31068	M	$\frac{14.}{14.}$	$\frac{((16.5))}{32.} = ((52))$	$\frac{7.4}{7.4}$		$\frac{5.6}{7.4} = 76$	40	
"	"	"	32034	M+	$\frac{14.5}{(26.)} = (56)$	$\frac{16.}{32.} = 50$	$\frac{5.}{6.5} = 77$	34	$\frac{6.}{6.5} = 92$	41	
<i>Meryceros joraki</i> , ref.....	"	"	31054	M	$\frac{13.9}{13.9}$	$\frac{19.2}{31.8} = 60$	$\frac{5.2}{8.} = 65$	37	$\frac{6.4}{8.} = 80$	46 47	

<i>Meryceros joraki</i> , ref.....	California Barstow	III	439	F.A.M. 31073	M	$\frac{13.2}{30.5}$	$\frac{((15.5))}{30.5}$	$\frac{6.8}{((51))}$	$\frac{5.6}{6.8} = 82$	42	
"	"	IV	"	31032	M	$\frac{14.}{32.3}$	$\frac{((17.5))}{32.3}$	$\frac{7.1}{((54))}$	$\frac{6.2}{7.1} = 87$	44 46	
"	"	III	"	31036	M+	17.	$\frac{17.}{34.}$	$\frac{4.5}{7.}$	$\frac{6.1}{7.} = 87$	46	
"	"	"	"	31049	M+	$\frac{(16.)}{30.}$	$\frac{(17.)}{(35.)}$	$\frac{(17.)}{(35.)}$	$\frac{7.3}{7.}$	47	
"	"	"	441	31027	W	$\frac{17.5}{34.}$	$\frac{((16.))}{34.}$	$\frac{7.}{((47))}$	$\frac{5.5}{7.} = 79$	31	
" var.....	"	"	"	31055	M+	$\frac{14.}{(28.)}$	$\frac{(20.)}{(33.)}$	$\frac{(20.)}{(33.)}$	$\frac{5.4}{7.5}$	38	47
"	"	"	"	31057	M+	$\frac{13.3}{13.3}$	$\frac{20.}{29.}$	$\frac{20.}{29.}$	$\frac{6.}{7.9}$	45	47
<i>R. (Merriamoceros) coronatus</i> , ref.....	"	IV	437	31019	W	$\frac{13.}{19.}$	$\frac{18.}{27.7}$	$\frac{18.}{27.7}$	$\frac{5.}{7.}$	38	48 35A
"	"	"	"	31020	M	$\frac{12.7}{18.6}$	$\frac{18.7}{30.}$	$\frac{18.7}{30.}$	$\frac{5.4}{7.}$	43	54 35A
<i>Meryceros w. johnsoni</i> , ref.....	Nebraska Cherry Co. Crookston B. Q.	III	423	N.S.M. 33-15-8- 35	M+	$\frac{14.6}{28.}$	$\frac{19.}{35.5}$	$\frac{19.}{35.5}$	$\frac{6.}{7.4}$	41	42
"	"	IV	424	30-7-9- 34	W	$\frac{14.4}{14.4}$	$\frac{17.8}{33.}$	$\frac{17.8}{33.}$	$\frac{5.2}{6.7}$	36	42
" var.....	Valentine A Q.	"	426	1-27-8- 30	M+	$\frac{15.}{25.5}$	$\frac{17.5}{31.}$	$\frac{17.5}{31.}$	$\frac{5.1}{6.5}$	34	41

(Continued on next page)

TABLE VIII—Continued

	Locality	Size Group	Page	Collection No.	Tooth Wear	$\frac{m_3}{PS\ d.}$	$\frac{p_2-p_4}{m_1-m_3}$	$\frac{p_2}{p_4}$	$\frac{p_2}{m_3}$	$\frac{p_3}{p_4}$	$\frac{p_3}{m_3}$	See Fig.
	Nebraska Cherry Co., Valentine A Q.	IV	426	N.S.M. 20-11-8- 15	M+	$\frac{13.3}{25.5} = 52\%$	$\frac{17.8}{30.} = 59\%$	$\frac{5.}{7.} = 71\%$	38%	$\frac{6.}{7.} = 86\%$	45%	
	"	"	"	" 1C-15-7 -31	M	$\frac{13.2}{24.} = 55$	$\frac{18.2}{30.} = 61$	$\frac{5.3}{7.} = 76$	40	$\frac{6.6}{7.} = 94$	50	
	"	"	"	" 3-21-7- 30	M+	$\frac{13.}{24.} = 54$	$\frac{15.5}{29.} = 53$	$\frac{4.5}{6.} = 75$	35	$\frac{5.4}{6.} = 90$	42	
	"	"	427	6-23-8- 30	M+	$\frac{14.}{25.5} = 55$	$\frac{15.}{30.7} = 49$	$\frac{4.3}{6.3} = 68$	31	$\frac{5.5}{6.3} = 87$	39	
	New Mexico St. Cruz	"	402	F.A.M. 30964	M	$\frac{13.5}{26.} = 52$	$\frac{17.2}{30.} = 57$	$\frac{5.}{6.8} = 74$	37	$\frac{6.}{6.8} = 88$	44	41
	Round Mt.	III	393	31996	W		12.	$\frac{2.4}{5.4} = 44$		$\frac{4.1}{5.4} = 76$		38, 42
	"	"	"	32921	W	$\frac{15.5}{30.} = 52$	$\frac{14.4}{34.} = 42$	$\frac{4.}{6.2} = 65$	26	$\frac{5.}{6.2} = 81$	32	38
	"	IV	"	32943	M	$\frac{13.}{27.} = 48$	$\frac{15.}{31.} = 48$	$\frac{3.9}{6.5} = 60$	30	$\frac{5.2}{6.5} = 80$	40	
	Nebraska Cherry Co., Midway Q.	III	415	32354	W	$\frac{14.9}{23.5} = 63$	$\frac{18.5}{33.} = 56$	$\frac{5.}{7.2} = 69$	34	$\frac{6.5}{7.2} = 90$	44	
	"	IV	"	32365	M	$\frac{14.2}{24.} = 59$	$\frac{((16.))}{33.} = ((48))$	$\frac{5.7}{6.5} = 88$		$\frac{5.7}{6.5} = 88$	40	

<i>Cosoryz furcatus</i> , ref.....	IV	415	F.A.M. 32362	M+	$\frac{14.}{24.5} = 57$	$\frac{15.3}{33.}$	= 46	$\frac{4.}{6.4} = 63$	$\frac{5.5}{6.4} = 86$	29	$\frac{5.5}{6.4} = 86$	39
"	III	416	32071	M	$\frac{14.3}{22.5} = 64$	$\frac{18.7}{(35.)}$	= (53)	$\frac{5.4}{7.7} = 70$	$\frac{6.4}{7.7} = 83$	38	$\frac{6.4}{7.7} = 83$	45
<i>C. (Paracosoryz) sabulonis</i> or <i>C.</i> <i>(S.) savaronis</i> , ref., A var.....	IV	430	A.M. 26385	W	$\frac{13.2}{23.} = 57$	$\frac{17.5}{29.5}$	= 59	$\frac{5.}{7.} = 71$	$\frac{6.4}{7.} = 91$	38	$\frac{6.4}{7.} = 91$	48
<i>C. (P.) sabulonis</i> , type, B var....	"	431	14109	M+	$\frac{13.}{18.5} = 70$	$\frac{17.6}{29.}$	= 61	$\frac{4.4}{7.3} = 60$	$\frac{6.7}{7.3} = 92$	34	$\frac{6.7}{7.3} = 92$	52 44
<i>Ramoceros</i> , <i>Cosoryz</i> or <i>Meryceros</i> species.....	"	403	F.A.M. 30977	A	$\frac{12.}{30.2}$	$\frac{((16.5))}{(30.2)}$	= ((55))	$\frac{7.4}{7.4}$	$\frac{7.4}{7.4}$		$\frac{7.4}{7.4}$	
<i>Meryceros joraki</i> , tent. ref.....	"	441	31090	M	$\frac{13.5}{30.5}$	$\frac{((18.))}{30.5}$	= ((59))	$\frac{6.8}{6.8}$	$\frac{5.5}{6.8} = 81$		$\frac{5.5}{6.8} = 81$	41 46
"	"	442	31079	M+	$\frac{14.}{23.} = 61$	$\frac{18.}{30.5}$	= 59	$\frac{5.5}{7.} = 79$	$\frac{6.4}{7.} = 91$	39	$\frac{6.4}{7.} = 91$	46 46
"	"	"	31096	M	$\frac{11.5}{28.5}$	$\frac{(18.)}{28.5}$	= (63)	$\frac{6.8}{6.8}$	$\frac{6.5}{6.8} = 96$		$\frac{6.5}{6.8} = 96$	57
"	"	"	31080	W+	$\frac{14.5}{31.}$	$\frac{((16.))}{(31.)}$	= ((52))	$\frac{7.}{7.}$	$\frac{7.}{7.}$		$\frac{7.}{7.}$	
<i>C. (Subcosoryz) cerroensis</i> , sub- genotype.....	V	392	32978	M+	$\frac{14.2}{28.5} = 50$	$\frac{13.3}{32.}$	= 42	$\frac{3.3}{5.8} = 57$	$\frac{4.6}{5.8} = 79$	23	$\frac{4.6}{5.8} = 79$	32 42
" ref.....	"	394	32938	M+	$\frac{13.8}{28.5} = 48$	$\frac{13.3}{28.}$	= 48	$\frac{3.6}{6.} = 60$	$\frac{4.8}{6.} = 80$	26	$\frac{4.8}{6.} = 80$	35 38
"	"	"	32940C	-M	$\frac{12.5}{27.5} = 45$	$\frac{31.}{31.}$		$\frac{6.2}{6.2}$	$\frac{6.2}{6.2}$		$\frac{6.2}{6.2}$	

(Continued on next page)

TABLE VIII—Continued

	Locality	Size Group	Page	Collection No.	Tooth Wear	$\frac{m_3}{PS \text{ d.}}$	$\frac{p_2-p_4}{m_1-m_3}$	$\frac{p_2}{p_4}$	$\frac{p_2}{m_3}$	$\frac{p_3}{p_4}$	$\frac{p_2}{m_3}$	
<i>C. (Subcosoryx) cerroensis</i> , tent. ref.....	New Mexico Pojuaque Bluffs	V	396	F.A.M. 30982	M+	$\frac{14.5}{29.2} = ((14.))$	$\frac{29.2}{29.2} = ((48))\%$	$\frac{5.6}{5.6}$	$\frac{4.5}{5.6} = 80\%$	$\frac{5.6}{5.6}$	$\frac{4.5}{5.6} = 80\%$	See Fig. 41
(?) <i>R. (Paramoceros) marthæ</i> , ref.	Round Mt.	IV	403	32953	M+	13.	29.	$\frac{7.5}{7.5}$	$\frac{6.4}{7.5} = 85$	$\frac{6.4}{7.5} = 85$	$\frac{6.4}{7.5} = 85$	38
<i>Meryceros warreni johnsoni</i> , ref. or var.....	Nebraska Cherry Co., Crookston B. Q.	V	425	N.S.M. 27-15-8-35	W	$\frac{14.4}{31.} = 46\%$	$\frac{15.6}{29.} = 54$	$\frac{4.7}{6.5} = 72\%$	$\frac{5.7}{6.5} = 88$	$\frac{5.7}{6.5} = 88$	$\frac{5.7}{6.5} = 88$	40
" (<i>p.</i> rudimentary)	"	"	"	7-9-8-34	M+	$\frac{13.}{30.} = 43$	$\frac{14.8}{30.} = 49$	$\frac{3.}{6.3} = 48$	$\frac{5.6}{6.3} = 90$	$\frac{5.6}{6.3} = 90$	$\frac{5.6}{6.3} = 90$	43
<i>C. (Paracosoryx) sabulonis</i> , or <i>C. (S.) savaronis</i> , tent. ref.....	Nebraska Sioux Co.	"	432	A.M. 26888	W	$\frac{12.4}{28.}$	$\frac{16.}{28.} = 57$	$\frac{4.6}{6.} = 77$	$\frac{5.7}{6.} = 95$	$\frac{5.7}{6.} = 95$	$\frac{5.7}{6.} = 95$	46
<i>Meryceros joraki</i> , tent. ref.....	California Barstow	"	443	F.A.M. 31095	M+	$\frac{11.5}{27.} = ((16.))$	$\frac{27.}{27.} = ((59))$	$\frac{7.}{7.}$	$\frac{6.2}{7.} = 89$	$\frac{6.2}{7.} = 89$	$\frac{6.2}{7.} = 89$	46
(?) <i>Submeryceros minor</i> , type....	New Mexico Tesuque	VI	403	30988	M		$\frac{((16.))}{((16.))}$	$\frac{6.4}{6.4}$	$\frac{5.8}{6.4} = 91$	$\frac{5.8}{6.4} = 91$	$\frac{5.8}{6.4} = 91$	41
" ref.....	Cuyamungue	"	"	30985	W	$\frac{10.5}{18.} = ((11.))$	$\frac{24.5}{25.} = ((57))$	$\frac{6.}{6.}$	$\frac{5.5}{6.} = 92$	$\frac{5.5}{6.} = 92$	$\frac{5.5}{6.} = 92$	41
(?) <i>S. minor pauniensis</i> , type....	Colorado Pawnee Creek	"	407	31643	W	$\frac{((11.))}{18.} = ((61))$	$\frac{15.5}{25.} = ((62))$	$\frac{4.5}{6.} = 75$	$\frac{5.5}{6.} = 92$	$\frac{5.5}{6.} = 92$	$\frac{5.5}{6.} = 92$	43
(?) <i>S. minor serpentinus</i> , type....	Nebraska Sioux Co.	"	433	31577	M	$\frac{10.1}{16.} = 63$	$\frac{16.}{25.} = 64$	$\frac{4.2}{6.1} = 69$	$\frac{5.5}{6.1} = 90$	$\frac{5.5}{6.1} = 90$	$\frac{5.5}{6.1} = 90$	44
(?) <i>S. minimus</i> , type.....	New Mexico Cuyamungue	VII	404	30991	M+	$\frac{9.}{21.6} = ((11.5))$	$\frac{((11.5))}{21.6} = ((53))$	$\frac{5.}{5.}$	$\frac{5.5}{5.} = 90$	$\frac{5.5}{5.} = 90$	$\frac{5.5}{5.} = 90$	41

() approximate; (()) estimated.

The amassed data as to dentitions of the Merycodontini (see pages 313 and 372, also compare the forty-seven named and unnamed species, subspecies and vars., listed page 317, and the immediately preceding Measurement Table VIII, page 384) are recorded under the six geographic areas (see page 373) of:

- (1) New Mexico
- (2) Colorado
- (3A) South Dakota, (3B) Kansas and (3C) Montana
- (4) Nebraska
- (5) California
- (6) Nevada and Oregon.

(1) Merycodontini Dentitions from New Mexico

Ramoceros, Paramoceros, Cosoryx, Subcosoryx, Meryceros and Submeryceros species

(See Horn Section II, page 323)

Figures 41, 42 and (in part) 38

New Mexico Merycodontine dentitions in our collections are represented by some two hundred and eleven partial mandibular and ninety-four partial maxillary series listed below, and by one thousand two hundred and seventy mentioned partial rami and maxillæ, and numerous fragments. While all of the molars are tall-crowned and the diastemata average moderately long to long, with no evidence of the occurrence of forms with short diastemata, there are considerable differences in size and in the proportions of the premolars. These ramal and maxillary dentitions, as observed in the Merycodontini discussion, are referred to II-VII of the tentative size groups (of the general Merycodontini-Blastomerycini size-group scheme, Size Group I being unrepresented in typical Merycodontine remains). From the infrequency of the occurrence of horns of *Paramoceros* and *Submeryceros*, it may be presumed, perhaps, that they rarely are represented by the dentitions. From the frequency of the occurrence of horns of *Meryceros*, it may be presumed that the group is particularly well represented in the collections of mandibles from the same areas. Two rami are associated with cranial portions of *Ramoceros*.

Size Group II proper is rare. The molars are heavier-lobed and the diastemata relatively shorter than in the following groups. Several of these rami might be referred equally well to *Plioceros blicki*, n.g. and sp.

Size Groups IIA and III are the commonest, and exhibit moderate variations of types with long symphyses and tall molars. These mandibular remains probably represent no more than smaller and larger individuals of the same form. In IIA the diastemata are relatively slightly longer and the premolar series slightly larger than in Group III. A single ramus (F:A.M.30976) of Size Group III exhibits a notably large p_4 and an m_3 with strongly convex posterior border, well-marked rib and total absence of p_2 .

A ramus of Size Group IIA (F:A.M.31592) and a maxilla and skeletal elements are associated with the cranial saddle and horns of *Ramoceros ramosus* (Cope), referred. A right ramus (F:A.M.31711) is associated with a partial skeleton of Size Group III from an horizon above Skull Ridge. A somewhat shorter-diastemaed specimen is observed in F:A.M. 30961, Size Group IIA. This last specimen rather closely approximates Cherry County, Nebraska, specimens exemplified by N.S.M.14-22-8-30.

Size Group IV, except for possibly slightly larger-proportioned premolars, has the characters of Size Group III, with the exception of the *Subcosoryx* remains (s.g. IV-V) in which the anterior premolars are greatly reduced.

As remarked in the discussion, specimens of the notably smaller Size Groups VI-VII are made the types of two new species of *Submeryceros*. Size Group VI, (?)*S. minor*, and Size Group VII, (?)*S. minimus*, respectively represent more diminutive-sized forms in which, unfortunately, the diastema lengths are unknown and the presence or absence of antlers remains in question. Size Group VI exhibits relatively large premolars and Size Group VII a generally more evenly proportioned tooth series.

Representative specimens of the several size groups are figured in adjacent plates (Figs. 41, 42). The remains are taken up in detail in subsequent pages according to the above order.

The above-noted New Mexican ramal and maxillary dentitions are listed under *C. (Subcosoryx) cerroensis*, n.subg. and sp., Size Groups III-V, and indefinitely under *Ramoceros*, *Paramoceros*, *Cosoryx*, *Meryceros* and *Submeryceros* species, divided between Size Groups II-VII.

SIZE GROUPS III-V.

C. (Subcosoryx) cerroensis, new subgenus and species

From Round Mountain Quarry, Santa Clara, New Mexico

SUBGENOTYPE.—Left ramus with I_1-I_3 , /C and p_2-m_3 . . . (M+) F:A.M.
Fig. 42 32978

REFERRED FROM TYPE LOCALITY.—

The referred specimens, in addition to some eighty-nine "horns" (p. 336) and twenty-four limb elements (p. 456), include the one hundred and fifty-two maxillary and mandibular specimens of larger and smaller individuals listed below under Size Groups III to V. The mandibular specimens are characterized by reduction of the premolars, particularly p_2 and p_3 , and elongation and slenderness of the diastema. (F:A.M.32923 differs in both the shortness of the diastema and in the non-eruption of p_2 .) The smallest p_2 is seen in F:A.M.31996 (2.4 mm.); the largest p_2 in F:A.M.32921 (4.5 mm.); the smallest m_3 in F:A.M.32940C (M) (12.5 mm.); and, excepting extremely worn specimens, the largest m_3 in F:A.M.32921 (M+) (16 mm.). The third lobe of m_3 is variably developed. The heaviest ramus is F:A.M.32946; the slenderest is F:A.M.32955D.

SEVENTY-SEVEN MANDIBULAR RAMI

S.G. III.

Three relatively large specimens with anterior premolars greatly reduced:

		F:A.M.
Left ramus with p_2 - m_3 (br.).....	(w)	31996
	<i>Figs. 38, 42</i>	
Left fragment with symphysis, p_2 root and p_3 - p_4	(w)	32920
Right fragment with diastema, p_2 root and p_3 - m_1	(w)	32920A

Six less large:

Right ramus with p_2 root and p_3 - m_3	(M+)	32922
Left ramus with diastema and p_2 - m_3	(w)	32921
	<i>Fig. 38</i>	
Left ramus with p_2 - m_3	(M++)	32921A
Left fragment with p_3 - m_3	(-M)	32929
Right fragment with p_4 - m_3	(w)	32933
Left fragment with p_4 - m_3	(M)	32933A

S.G. IV.

Twenty-seven smaller:

Mandible with symphysis, /Is, /Cs and p_2 - m_3 . (See questionably assoc. horn, Horn Section II, p. 338.)..	(w)	33117
Partial mandible with right I_1 - I_3 , /C root and p_2 - m_3	(M)	32943
Right ramus with diastema and p_2 - m_3	(w)	32941
Right ramus with symphysis, /I, p_2 - p_3 alveoli, p_4 - m_3 ..	(M)	32930
Right ramus with symphysis, p_2 - m_1 (br.) and m_3	(w)	32946
Left ramus with diastema, p_2 root and p_3 - m_3	(w)	32928
Right ramus with diastema, p_2 alveolus and p_3 - m_3	(M+)	32928A
Left ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3	(M++)	32945
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ...	(M++)	32945A
Left ramus with symphysis, p_2 alveolus and p_3 - m_3	(M)	32945B
Mandibular symphysis with right ramus, /Is and /Cs roots, p_2 alveolus, p_3 (br.), p_4 - m_3 (br.).....	(w+)	32945C
Left fragment with p_2 - m_3	(M+)	32945D
Left fragment with p_2 - m_3	(M+)	32942
Right ramus with p_2 alveolus and p_3 - m_3	(M++)	32925
Left fragment with p_3 - m_3	(M+)	32925A
Right ramus with p_2 alveolus and p_3 - m_3 (br.).....	(M)	32924
Right fragment with p_2 alveolus and p_3 - m_3 (br.).....	(w)	32949A
Left ramus with p_2 (br.)- m_1 (br.) and m_2 - m_3	(w)	32925B
Left fragment with p_2 alveolus and p_3 (br.)- m_3 (br.)...	(M+)	32936
Left fragment with p_2 alveolus and p_3 - m_3	(M+)	32936A
Right ramus with p_2 alveolus and p_3 (br.)- m_3	(w)	32936B
Right fragment with symphysis and p_2 - m_2	(M++)	32937
Left ramus with symphysis, /ps alveoli and m_1 - m_3	(w)	32927
Right ramus with p_2 - m_1 and m_3	(M)	32931
Left fragment with p_2 alveolus and p_3 - m_3 (br.).....	(M++)	32932
Left ramus with broken p_3 - m_1 and m_2 - m_3	(w)	32935
Right fragment with p_3 alveolus and p_4 - m_3 (br.).....	(M+)	32934

S.G. V.

Twenty-two large:

		F:A.M.
Right ramus with I_1-I_2 , /C and p_2-m_2	(w)	32956
Partial mandible with right I_1-I_2 , ?/C and p_2-m_2	(M)	32955
Partial mandible with left I_1-I_2 , /C alveolus and p_2-m_2	(w)	32955A
Left ramus with left ?/C and p_2 (br.)- m_2	(M)	32955B
Right ramus with symphysis and p_2-m_2 (br.).....	(M++)	32955C
Left ramus with symphysis and p_2 (br.)- m_2	(M)	32955D
Left ramus with symphysis, p_2 alveolus and p_3-m_3 . (See questionably associated horn, Horn Section II, page 337.).....	(M+)	33112X
Right ramus with diastema and p_2-m_2	(M)	32955E
Left ramus with p_2-m_2	(w)	32955F
Left ramus with diastema and p_2-m_2	(M+)	32955G
Right ramus with p_2-m_2	(M)	32955H
Right ramus with symphysis, /I, p_2 alveolus and p_3-m_3	(M+)	32955I
Right ramus with diastema, p_2-p_3 alveoli and p_4-m_3	(-M)	32955J
Right ramus with diastema and p_3-m_3	(M++)	32947
Right ramus with symphysis, p_2-p_3 alveoli, p_4 (br.)- m_2 (br.) and m_2 (br.).....	(w)	32947A
Left fragment with p_2-m_2 (br.).....	(M++)	32947B
Right ramus with p_2-m_2	(M++)	32947C
Left fragment with p_2-m_2	(w)	32949G
Left fragment with p_2-m_2 (br.).....	(M++)	32949H
Left fragment with p_2-m_2	(w+)	32949E
Right fragment with p_2-m_2 (m_2 br.).....	(w)	32938A
Left fragment with p_2 alveolus and p_3-m_3 (br.).....	(M++)	32938B

Nineteen smaller:

Left ramus with symphysis, roots of I_2 -/C and p_2-m_2 ..	(M+)	32938
	Fig. 38	
Right ramus with diastema and p_2-m_2	(M)	32939
Left ramus with symphysis and p_2-m_2	(w+)	32939A
Left ramus with symphysis, p_2 alveolus, p_3 (br.)- m_3 (br.).....	(w)	32944
Left ramus with diastema and p_2-m_2	(M)	32944A
Left ramus with p_2-m_2	(M+)	32940
Left ramus with p_2-m_2	(M+)	32940A
Left ramus with symphysis, p_3 alveolus, p_4-m_3 (m_1 br.).....	(M++)	32940B
Left ramus with symphysis, p_2-p_3 alveoli and p_4-m_3	(-M)	32940C
Left fragment with symphysis, roots /Is-/C, p_2 alveolus and p_3-m_2	(w)	32940D
Left fragment with symphysis, p_2 alveolus, p_3-m_3 (br.).....	(M)	32940E
Left ramus with diastema and p_2-m_2	(w+)	32949D
Right ramus with p_2 root and p_3-m_3	(w)	32949C
Right ramus with p_2-m_2	(w+)	32940F
Left fragment with diastema, p_2 alveolus, p_3-m_3 (br.).....	(-M)	32949B
Right fragment with p_2-m_2	(w)	32940G
Right ramus with p_2 (br.)- m_2	(M)	32940H
Left fragment with p_2-m_2	(w+)	32940I
Left ramus with p_2 root and p_3-m_3 (br.).....	(M+)	32948

Four hundred and thirty partial and fragmental rami of both size groups, F:A.M. Coll.

FORTY-ONE MAXILLARY SPECIMENS

S.G. IV.

Thirteen large:

		F:A.M.
Right p^2-p^3 , p^4 alveolus and m^1-m^3	(M)	32951
Left p^2-m^3	(W)	32951E
Left p^2-m^3	(W++)	32951B
Left $p^3(br.)-m^3(br.)$	(M+)	32951F
Left p^4-m^3	(M++)	32952F
Right p^4-m^3	(M)	32951G
Left p^3-m^2	(-M)	32951A
Right p^3-m^2	(M)	32951H
Right p^4-m^3	(M++)	32951I
Four fragments with m^1-m^3	(W)	32951J-M

Sixteen smaller:

Left p^3-m^3	(M)	32952G
Left $p^2-m^3(br.)$	(W)	32952H
Left p^2-m^3	(W)	32952I
Left p^3-m^3	(W)	32952A
Left p^3-m^3	(W)	32952C
Left p^2-m^3	(M++)	32952J
Right p^3-m^3	(W)	32952K
Left p^2-m^2	(M++)	32952L
Left p^2-m^2	(W)	32952B
Left p^2-m^2	(W+)	32952D
Left p^4-m^3	(M+)	32952E
Left p^4-m^3	(W+)	32952M
Right $p^4-m^3(br.)$	(-M)	32952N
Left p^2 and m^1-m^3	(W)	32952P
Right $p^3(br.)$ and m^1-m^3	(M+)	32952Q
Right m^1-m^3	(W)	32952R

S.G. V.

Nine large:

Left p^2-m^3	(M+)	32952
Right $p^3(br.)-m^3$	(M+)	32957
Left p^2-m^2	(M)	32957A
Left p^2-m^2	(M)	32957B
Right p^3-m^3	(M+)	32957C
Left p^2-p^3 roots and p^4-m^3	(W)	32957D
Left p^4-m^3	(W)	32957E
Left p^3-m^3 (m^1 br.).....	(W+)	32957F
Right m^1-m^3	(M+)	32957G

Three smaller:

Left p^2-m^3	(W)	32958
Right p^3-m^3	(M++)	32958A
Right p^3-m^2	(M++)	32958B

One hundred and forty partial maxillæ and numerous detached upper teeth of both size groups, F:A.M. Coll.

TWENTY-SIX IMMATURE RAMI

F:A.M.

Right ramus with symphysis, I_1 - I_3 and dp_2 - m_1	32950
Left ramus with diastema and dp_2 - m_2	32950A
Right ramus with dp_2 - m_2	32950B
Right ramus with dp_2 - m_2 (erupting).....	32950K
Right ramus with diastema and dp_2 - m_2	32950L
Fragment with /Is-/Cs.....	32950C
Right ramus with diastema and dp_2 - m_2 (erupting).....	32950M
Left ramus with dp_2 - m_2 (erupting).....	32950D
Left ramus with dp_2 - m_2 (erupting).....	32950N
Left ramus with diastema and dp_2 - m_2 (erupting).....	32950E
Right ramus with diastema and dp_2 - m_1 (br.).....	32950F
Left ramus with dp_2 - m_2	32950P
Right ramus with dp_2 , roots dp_3 and dp_4 - m_2	32950G
Left fragment with dp_2 - m_2	32950H
Left fragment with partial diastema and dp_2 (br.)- m_1 .	32950I
Right fragment with diastema and dp_2 - m_1	32950J
Right fragment with dp_2 - m_2	32950Q
Left fragment with dp_2 - m_1	32950R
Right fragment with dp_2 - m_1	32950S
Left fragment with dp_2 - m_1	32950T
Right fragment with dp_2 - m_1	32950U
Left ramus with diastema and dp_2 (br.)- m_2	32950V
Left ramus with dp_2 - m_1 (br.) and m_2	32950W
Right fragment with dp_2 - m_1	32950X
Right fragment with dp_2 - m_1	32950Y
Right fragment with dp_2 - dp_4 . (Note large dp_2 .).....	32950Z
Two hundred and ten partial and fragmental immature rami, F:A.M. Coll.	

FIVE IMMATURE MAXILLÆ

Left dp^2 - m^1	32959
Left dp^2 - m^1	32959A
Left dp^2 - m^1	32959B
Right dp^2 - m^1 (br.).....	32959C
Left dp^2 - m^2	32959D
Thirty-four partial immature maxillæ, F:A.M. Coll.	

TENTATIVELY REFERRED FROM OTHER NEW MEXICAN LOCALITIES.—

s.g. v. Premolars as small as in above.

Right fragment with p_2 alveolus and p_2 - m_2 . (M+)	F:A.M.30982	From Pojuaque Bluffs, 1927. This paper, <i>Fig. 41</i> .
Left fragment with m_1 (br.) and m_2 - m_3 .	F:A.M.30983	From Ojo Caliente, 1931.

SIZE GROUP IV.

Undetermined Species

From Round Mountain Quarry, 1936

(Compare *P. marthæ*, page 403). In the example (F:A.M.32923), the postsymphysial distance is 19 mm. and m_3/PS . d. = 66%, versus in *C. (S.) cerroensis* type ramus (F:A.M.32978), in which the postsymphysial distance is 28.5 mm. and m_3/PS . d. = 50%.

EXAMPLE.—Left ramus with symphysis, /C(erupting), detached p_2 germ and p_2 (br.)- m_3 (M) F:A.M. 32923

REFERRED.—

Right ramus with diastema, p_2 (br.), p_3 (roots) and p_4 - m_3 (w+) 32960
Left ramus with diastema and p_2 - m_3 (w) 32961

(?)Var.

Diastemata missing, premolars relatively large, and suggestive of the above rather than *C. (S.) cerroensis*.

EXAMPLE.—Left ramus with p_2 - m_3 (M) F:A.M. 32962

REFERRED.—

Right ramus with p_2 (br.)- m_3 (M+) 32963
Right fragment with p_3 (br.)- m_3 (M) 32964
Left fragment with p_2 - m_3 (br.)..... (M+) 32926
Right fragment with p_2 - m_3 (br.) and m_3 (w) 32965
Right fragment with p_4 - m_3 (teeth br.)..... (w) 32965A
Right fragment with p_4 - m_3 (w) 32948A
Left fragment with p_4 - m_3 (M++) 32965B
Right ramus with p_4 - m_3 (teeth br.)..... (w) 32965C

SIZE GROUPS II-IVA.

Ramoceros, Cosoryx or Meryceros species

S.G. II.

EIGHT RAMI

Four from Santa Cruz:

Right ramus with symphysis and p_2 - m_3 . (w) F:A.M.30915 From 1st wash, 1930.
This paper, Fig. 42.
Left fragment with m_2 - m_3 (br.). (M) F:A.M.30919 From 1st wash, 1928.
Left fragment with m_2 (br.). (M) F:A.M.30920 From 1st wash, 1928.
Left fragment with m_2 - m_3 (br.). (w) F:A.M.30922 From 2d wash, 1927.

Two from Santa Clara:

Left ramus with symphysis, p_2 - p_3 and m_1 - m_3 . (w) F:A.M.30916 From Rio Grande slope, 1931.
Right fragment with m_2 - m_3 . (w) F:A.M.30918 1930.

Two from San Ildefonso area:

Left fragment with p_2 - m_1 alveoli and m_2 - m_3 (br.).	F:A.M.30917	1929.
Partial left ramus with p_2 - p_4 , m_1 alveolus and m_2 - m_3 . (M)	F:A.M.30928	1930.

MAXILLA

One from indefinite locality:

Partial left maxilla with p^4 (br.)- m^2 . (w+)	F:A.M.31965	1926.
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S.G. IIA.

TWENTY-THREE RAMI

Twelve from Santa Cruz:

Right ramus with sym- physis, p_2 - p_3 alveoli and p_4 - m_3 . (A)	F:A.M.30925	From 1st wash, 1928. This paper, <i>Fig. 42</i> .
Left ramus with symphy- sis, p_2 - m_3 . (M+)	F:A.M.30961	1927. This paper, <i>Fig. 42</i> .
Partial left ramus with p_2 - m_3 (p_2 br.). (w)	F:A.M.30929	From 1st wash, 1928.
Partial left ramus with p_2 - m_3 . (M)	F:A.M.30956	1927.
Partial left ramus with p_2 - m_3 (/ms br.). (w)	F:A.M.30927	From 1st wash, 1928.
Partial left ramus with p_2 - m_3 (p_4 and m_3 br.). (w)	F:A.M.30935	From 1st wash, 1928.
Partial left ramus with p_2 - m_3 (br.). (w)	F:A.M.30936	From 1st wash, 1928.
Partial left ramus with p_4 - m_3 . (w)	F:A.M.30937	From 1st wash, 1928.
Right fragment with p_2 - m_3 (br.). (w)	F:A.M.30938	From 1st wash, 1928.
Left fragment, p_4 - m_3 . (M+)	F:A.M.30940	From 1st wash, 1928.
Left fragment with p_2 - p_3 alveoli and p_4 - m_3 . (w)	F:A.M.30931	From 1st wash, 1928.
Partial left ramus with p_2 - m_3 . (M+)	F:A.M.30933	From upper layer, 1927.

Five from Santa Clara:

Left ramus with symphy- sis, I_2 - I_3 , /C root, p_2 al- veolus and p_3 - m_3 . (M)	F:A.M.30924	1931. This paper, <i>Fig. 42</i> .
Left ramus with symphy- sis, p_2 - p_4 alveoli and m_1 - m_3 (m_1 - m_2 br.). (M+)	F:A.M.30926 (Smaller)	1927.
Right ramus with sym- physis, p_2 , m_1 - m_3 . (w)	F:A.M.30943	1929.
Partial right ramus with p_2 - m_3 . (w)	F:A.M.30932	1931.
Partial right ramus with diastema, p_2 - p_3 alveoli, p_4 - m_3 (teeth broken). (M+)	F:A.M.30942	1929.

Four from Pojuaque Bluffs:

Partial right ramus with p_2 alveolus, p_3 - m_3 . (M+)	F:A.M.30930	1929.
Partial right ramus with p_2 alveolus, p_3 - m_3 . (w)	F:A.M.30939	1927.
Left fragment, p_4 - m_3 . (w)	F:A.M.31592	1929.

(*Ramoceros ramosus* (Cope), referred. See associated cranium, maxilla and limbs, Horn Section II, page 324; this Section, below; and Limb Section IV, page 453. This paper, *Figs. 28, 28A, 29, 30* [cranium and horns], *25B, 48* [limbs].)

Mandible with symphysis, p_3 - m_3 . (w+)	F:A.M.30941	1929.
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[*Ramoceros ramosus* (Cope), referred. See associated maxilla below, and limbs, Section IV, page 453.]

Two from Skull Ridge:

Right fragment with p_2 alveolus and p_3 - m_3 . (w)	F:A.M.31711	1931.
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(See associated partial skeleton, Limb Section IV, page 457.)

Partial left ramus with p_2 - m_3 . (w)	F:A.M.30934	1929.
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NINETEEN MAXILLÆ

Nine from Santa Cruz:

Right maxilla, p^3 - m^3 . (w)	F:A.M.31966	1927.
Partial right maxilla with p^4 - m^3 . (w)	F:A.M.31967	1927.
Partial right maxilla with p^4 - m^3 . (w)	F:A.M.31968	1928.
Partial left maxilla with p^3 - m^3 . (w)	F:A.M.31969	1928.
Partial right maxilla with m^1 - m^3 . (M+)	F:A.M.31970	1927.
Partial skull, p^2 - m^3 . (M)	F:A.M.31971	From 1st wash, 1928.
Partial left maxilla with p^4 - m^3 . (M+)	F:A.M.31972	From 1st wash, 1928.
Partial right maxilla with p^4 - m^3 . (M+)	F:A.M.31973	From 1st wash, 1928.
Partial right maxilla with p^4 - m^3 . (w)	F:A.M.31974	From 1st wash, 1928.

One from Santa Clara:

Partial palate, p^4 - m^3 . (M+)	F:A.M.31975	1931.
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One from Lower Pojuaque Bluffs:

Partial left maxilla with p^2 - m^3 . (w)	F:A.M.31592	1929.
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(*Ramoceros ramosus* (Cope), referred. Above-noted cranium, ramus and limbs, Horn Section II, page 324; this Section, above; and Limb Section IV, page 453. This paper, *Figs. 28, 28A, 29, 30* [cranium and horns], *25B, 48* [limbs].)

One from Pojuaque Bluffs:

Partial left maxilla with m^1 - m^3 . (w)	F:A.M.30941	1929.
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[*Ramoceros ramosus* (Cope), referred. See associated mandible above, and limbs, Section IV, page 453.]

One from Skull Ridge:

Right maxilla with p^2-m^3 (p^4 br.). (M+)	F:A.M.31977	1926.
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One from southeast of White Operation:

Partial left maxilla with p^4-m^2 (br.). (w)	F:A.M.31978	1926.
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Five from indefinite localities:

Partial right maxilla with p^4-m^3 . (w)	F:A.M.31976	1925.
Partial left maxilla with p^4-m^3 . (M)	F:A.M.31979	1926.
Partial right maxilla with m^1-m^3 . (w)	F:A.M.31980	1925.
Partial left maxilla with m^1-m^3 . (M+)	F:A.M.31981	1926.
Partial right maxilla with m^1-m^3 . (M+)	F:A.M.31982	1925.

S.G. II^x.

RAMUS

One from Skull Ridge:

Partial right ramus with p_2 alveolus, p_3-m_3 . (M+)	F:A.M.30992	1930. This paper, <i>Fig. 42</i> .
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S.G. III.

TWENTY-THREE RAMI

* = p_2 large

Eleven from Santa Cruz:

Mandible with left sym- physis and p_2-m_3 . (w)	F:A.M.30946	1929.
Left ramus with symphy- sis, p_2 (br.), p_3-m_3 . (w)	F:A.M.30948	From 1st wash, 1928.
Right ramus with sym- physis, p_2 alveolus and p_3-m_3 (br.). (w)	F:A.M.30950	From 1st wash, 1928.
Left fragment with p_2-m_3 (br.). (w)	F:A.M.30952	From 1st wash, 1928.
Left fragment with p_2 al- veolus and p_3-m_3 . (M)	F:A.M.30954	From 1st wash, 1928.
Left fragment with p_2 (br.) and p_3-m_3 (br.). (M+)	F:A.M.30965	From 1st wash, 1928.
Right ramus with sym- physis, partial p_2-p_3 , and p_4-m_3 . (w)	F:A.M.30947	From 2d wash, 1930.
Right ramus with sym- physis, I_2-I_3 , /C, p_2 al- veolus and p_3-m_3 (br.). (w)	F:A.M.30963	1926.
Partial left ramus with p_2 alveolus and p_3-m_3 . (w)	F:A.M.30951	From upper layer, 1927.
Left fragment, p_2-m_3 . (M+)	*F:A.M.30953	From upper layer, 1927.
Right fragment with p_2 - p_3 alveoli and p_4-m_3 . (A)	F:A.M.30980 (/ms slender)	From 1st wash, 1928.

Four from Santa Clara:

Partial left ramus with p_2 - m_3 . (M)	F:A.M.30955	1929.
Right fragment with p_2 - p_3 alveoli, p_4 - m_3 . (M+)	F:A.M.30979	1931.
Right fragment with p_2 alveolus and p_3 - m_3 . (W+)	F:A.M.30959	1928.
Partial right ramus with p_2 - m_3 (m_2 br.). (M+)	*F:A.M.30960	1928.

Two from San Ildefonso (?*Cosoryx*, ref.):

Left fragment with p_2 alveolus and p_3 - m_3 . (W+)	*F:A.M.30958	1930.
Left fragment with p_3 alveolus and p_4 - m_3 . (M)	F:A.M.30976	1930.
(p_2 absent, p_4 unduly large and m_1 with style.)		This paper, Fig. 41.

Three from Pojuaque Bluffs:

Partial mandible with p_2 alveolus and p_3 - m_3 . (M)	F:A.M.31733	1929.
(See associated palate, next page.)		
Partial right ramus with p_2 - m_3 (m_1 br.). (A)	F:A.M.30949	1929.
Right ramus with symphysis and p_2 - m_3 . (M)	F:A.M.30944	1927.
		This paper, Fig. 41.

One from Skull Ridge:

Right ramus with symphysis and p_2 - m_3 . (M+)	F:A.M.30945	1927.
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Two from indefinite localities:

Left fragment with p_2 alveolus and p_3 - m_3 . (M)	F:A.M.30957	1929.
Right fragment with p_4 - m_3 . (M+)	F:A.M.30978	1928.

ELEVEN MAXILLÆ

Two from Santa Clara:

Right maxilla, p^2 - m^3 . (W+)	F:A.M.31987	1929.
Partial left maxilla with p^1 - m^2 . (M)	F:A.M.31988	1928.

Two from San Ildefonso:

Skull (female), p^2 - m^3 . (M)	F:A.M.31730	1929.
(? <i>Cosoryx ilfonsensis</i> , n.sp., referred. See associated limbs, Section IV, page 456.)		
Partial left maxilla with m^1 - m^3 . (M)	F:A.M.31989	1930.

Three from North Pojuaque Bluffs:

Left maxilla, p^2 - m^3 . (M)	F:A.M.31990	1927.
Left maxilla, p^2 - m^3 . (M)	F:A.M.31991	1927.
Partial left maxilla with p^2 - m^3 . (M)	F:A.M.31992	1927.

One from Pojuaque Bluffs:

Palate with p^2-m^2 . (M) F:A.M.31733 1929.
(See associated partial mandible, preceding page.)

Three from indefinite localities:

Right maxilla, p^2-m^2 . (M+) F:A.M.31993 1925.
Right maxilla, p^2-m^2 . (W) F:A.M.31994
Partial left maxilla with p^2-m^2 . (M+) F:A.M.31995 1927.

S.G. III'.

MAXILLA

One from Santa Cruz:

Left maxilla, p^2-m^2 . (A) F:A.M.31986 From 1st wash, 1928.
(Note p^3 !)

S.G. IV.

EIGHT RAMI

Four from Santa Cruz:

Left ramus with symphysis and p_2-m_3 . (M) F:A.M.30964 From District 1.
This paper, *Fig. 41*.
Right fragment with p_2 - p_3 alveoli and m_1-m_3 (/ms br.). (W) F:A.M.30968 From 1st wash, 1930.
Left fragment with p_4 alveolus and m_1-m_3 (m_2-m_3 br.). (W) F:A.M.30971 From 1st wash, 1928.
Left fragment with m_1 alveolus and m_2 . (W) F:A.M.30972 1928.

One from North Pojuaque Bluffs:

Left fragment with m_1-m_3 (m_2-m_3 br.). (M) F:A.M.30969 1927.

Two from the vicinity of Espanola:

Left fragment, p_1-m_3 . (W) F:A.M.30966 1929.
Right fragment with p_2 alveolus and p_3-m_1 . (M) F:A.M.30970 1928.

One from Tesuque:

Right fragment with m_1-m_3 (m_2 br.). (M+) F:A.M.30967 1931.

TWO MAXILLÆ

From Santa Cruz:

Partial left maxilla with p^2-m^2 . (W) F:A.M.31998 1927.
Right maxilla, p^2-m^2 . (M+) F:A.M.31999 1931.

s.g. IVA. (Large p_4 .)

RAMUS

One from Santa Cruz:

Right fragment with p_2 al-
veolus and p_4 - m_2 (m_2
br.). (A)

F:A.M.30977

From 1st wash, 1928.

MAXILLA

One from indefinite locality:

Partial right maxilla with
 p^4 - m^3 . (A)
(Note large p^3 .)

F:A.M.32000

Three hundred and forty-two unlisted partial rami, forty-seven unlisted partial maxillæ and numerous smaller fragments from Santa Fé area, F:A.M. Coll.

(?)*R. (Paramoceros) marthæ*, new species

From Round Mountain Quarry, New Mexico

REFERRED.—

Left ramus, p_2 - m_2 . (M+)

F:A.M.32953

This paper, *Fig. 38*.Left ramus, p_4 - m_2 . (M+)

F:A.M.32954

SIZE GROUP VI.

(?)*Submeryceros minor*, new speciesTYPE.—Left fragment with
 p_2 alveolus, p_2 - m_1 . (M)

F:A.M.30988

From Tesuque, 1930.
This paper, *Fig. 41*.

FOUR TENTATIVELY REFERRED RAMI.—

One from North Pojuaque Bluffs:

Right fragment with m_1
(br.)- m_2 . (A)

F:A.M.30989

1927.

Two from Cuyamungue:

Right fragment with p_2 -
 m_2 . (W)

F:A.M.30985

1931.
This paper, *Fig. 41*.Left fragment with m_1 -
 m_2 . (M)

F:A.M.30986

1930.

One from indefinite locality:

Right fragment with
 m_2 - m_3 (br.). (M)

F:A.M.30987

1928.

SIZE GROUP VII.

(?) *Submeryceros minimus*, new species

TYPE.—Right fragment with p ₂ -p ₃ alveoli and p ₄ -m ₃ (m ₃ br.). (M+)	F:A.M.30991	From Cuyamungue, 1933. This paper, <i>Fig. 41</i> .
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UNALLOCATED IMMATURE SPECIMENS:

TWENTY-FOUR RAMI, IMMATURE

Left ramus with symphysis, I ₁ and dp ₂ -m ₃ .	F:A.M.30993A	
Left ramus with symphysis, /Is roots and dp ₄ -m ₃ .	F:A.M.30993B	From Santa Clara, 1931.
Left ramus with symphysis and dp ₃ -m ₃ (erupting).	F:A.M.30993C	From Santa Clara Canyon, 1931.
Right ramus with symphysis and dp ₄ -m ₂ (teeth broken).	F:A.M.30993D	From Santa Clara Canyon, 1931.
Left ramus with symphysis and /Is-m ₃ .	F:A.M.30993E	From North Pojuaque Bluffs, 1927.
Left ramus with partial symphysis and dp ₂ -m ₃ (erupting).	F:A.M.30993F	From Lower Pojuaque Bluffs, 1928.
Partial left ramus with dp ₂ -m ₂ .	F:A.M.30993G	From 1st wash, Santa Cruz, 1928.
Right fragment, dp ₂ -m ₃ .	F:A.M.30993H	Santa Clara Canyon, 1931.
Left fragment, dp ₂ -m ₃ .	F:A.M.30993I	1927.
Left fragment, dp ₄ -m ₂ .	F:A.M.30993J	From Santa Clara, 1931.
Right fragment, dp ₂ -m ₂ .	F:A.M.30993K	1st wash, Santa Cruz, 1928.
Left fragment with dp ₂ -m ₂ (erupting).	F:A.M.30993L	1928.
Left fragment, dp ₃ -m ₂ .	F:A.M.30993M	From Santa Cruz, 1927.
Left fragment, dp ₂ -m ₃ .	F:A.M.30993N	Santa Clara Canyon, 1931.
Right fragment, dp ₂ -m ₂ .	F:A.M.30993O	
Partial right ramus with dp ₃ -m ₂ .	F:A.M.30993P	From 1st wash, Santa Cruz, 1928.
Right fragment with dp ₄ -m ₃ (erupting).	F:A.M.30993Q	From upper layer, Santa Cruz, 1927.
Right fragment, dp ₂ -m ₁ .	F:A.M.30993R	1st wash, Santa Cruz, 1930.
Left fragment, dp ₂ -m ₂ .	F:A.M.30993S	
Right fragment, dp ₄ -m ₂ .	F:A.M.30993T	1st wash, Santa Cruz, 1928.
Left fragment, dp ₂ -m ₂ .	F:A.M.30993U	From San Ildefonso, 1930.
Left fragment, dp ₂ -m ₁ .	F:A.M.30993V	Santa Clara Canyon, 1930.
Right fragment, dp ₂ -dp ₄ .	F:A.M.30993W	1927.
Left fragment with dp ₂ -m ₁ .	F:A.M.30993X	Between old and new Santa Fé roads, 1926.

Sixty-three unlisted immature partial rami and numerous fragments, F:A.M. Coll.

TWELVE MAXILLÆ, IMMATURE

Palate with dp^2-m^2 .	F:A.M.30994A	From Santa Clara, 1931.
Right maxilla, dp^2-m^2 .	F:A.M.30994B	Santa Clara Canyon, 1930.
Left maxilla with dp^2-m^1 .	F:A.M.30994C	From Santa Clara, 1928.
Right maxilla, dp^2-m^2 .	F:A.M.30994D	From Santa Clara, 1931.
Right maxilla, dp^2-m^2 .	F:A.M.30994E	From Santa Clara, 1931.
Right maxilla, dp^2-m^1 .	F:A.M.30994F	From Santa Clara, 1931.
Left maxilla with dp^2-m^1 .	F:A.M.30994G	From Santa Clara, 1931.
Left maxilla with dp^2-m^1 .	F:A.M.30994H	From Santa Clara, 1931.
Left maxilla with dp^2-m^1 .	F:A.M.30994I	1st wash, Santa Cruz, 1928.
Right maxilla with dp^2-m^2 (erupting).	F:A.M.30994J	From North Pojuaque Bluffs, 1927.
Right maxilla, dp^2-m^2 .	F:A.M.30994K	From Santa Cruz, 1927.
Left maxilla with dp^2-m^1 .	F:A.M.30994L	From Santa Cruz, 1925.

Four unlisted immature partial maxillæ, F:A.M. Coll.

(2) Merycodontini Dentitions from Colorado

Ramoceros, Cosoryx, [Meryceros] and Submeryceros species

Figure (in part) 43

The few known Pawnee Creek, Colorado, dentitions are of Size Group III, with the exception of the single examples of Size Groups II, IV and VI. The Size Group VI ramus, as in the case of similar specimens from New Mexico, is set apart under (?) *Submeryceros*, (?) *S. minor pawniensis*, n.subsp.

SIZE GROUP II.

RAMUS

One from "Horse" Quarry:

Right fragment with broken m_1-m_2 .	F:A.M.31634	1933.
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SIZE GROUP III.

TEN RAMAL DENTITIONS

Two from Cedar Creek:

Ramal dentition of geno- type. (w++)	A.M.9476	1901. Figured by Matthew, 1904, Pl. III and Text-Fig. 1; this paper, Fig. 43 (ramus).
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[Genotype of *Ramoceros osborni* (Matthew). See Horn Section II, page 328; this paper, Figs. 23, 23A (cranium); and associated limb elements, Section IV, page 454.]

Left maxilla with p^2-m^3 (w); and very question- ably associated right ramus with p_2-m_2 .	A.M.9475	1901. Figured by Matthew, 1904, Figs. 7 (maxilla), 8 (ramus), as cotype of <i>M. osborni</i> .
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(Tentatively referred to *Cosoryx furcatus*, var. or subsp., heretofore known as part of "cotype" of *M. osborni* Matthew. See questionably associated horns, Section II, page 346; and limb elements, Section IV, page 461.)

Six from "Horse" Quarry:

Mandible with symphysis and p_2-m_2	(w+) Fig. 43	1932	F:A.M. 31635
Partial right ramus with p_2-m_2	(w) Fig. 43	1932	31636
Right fragment with p_2 alveolus and p_2-m_2 (br.)..	(M)	1933	31638
Right fragment with m_1-m_2 (m_1-m_2 br.).....	(M)	1933	31639
Right fragment with m_2	(M+)	1932	31641
Left fragment with m_2	(M)	1932	31642

Two from Mastodon Quarry:

F:A.M.

Right fragment with p_2 alveolus and p_2 - m_2	(M)	1932	31637
Left fragment with p_2 - m_1	(M)	1931	31640

SIZE GROUP IV.

MAXILLA

Right maxilla, p^2 - m^2 . (w) A.M.22710 40 miles N. of Sterling, 1901.
 (*Cosoryx furcatus*, var. or subsp. See questionably associated horn, Section II, page 346.)

SIZE GROUP VI.

(?) *Submeryceros minor pawniensis*, new subspecies

TYPE.—Left ramus with p_2 - m_2 (br.). (w) F:A.M.31643 From Lower Mastodon Quarry, 1932.
 This paper, Fig. 43.

REFERRED FROM TYPE LOCALITY.—

Left fragment, m_1 - m_2 . (A) F:A.M.31644 1932.

(3A) Merycodontini Dentitions from Little White River, South Dakota

Cosoryx furcatus, Var. or Subsp.

Figures (in part) 43, 45

The few available Merycodontine dentitions from the Little White River, South Dakota, are referred to *Cosoryx* Leidy on account of the known horns from the same area being confined solely to that genus. The latter possibly was the predominant genus in South Dakota as in northern Nebraska. The specimens include some seven fragmental rami of the Hayden Survey collection, now in the Academy of Natural Sciences of Philadelphia, which the writer has had the privilege of examining and which apparently formed the major part of the data available to Leidy. [Unfortunately there is not found in the Academy's collection a specimen with p_4-m_1 , or one which might represent the Leidy (1869) type.] The American Museum collection contains a broken ramus from the general area (A.M.9825X, 1902). W. D. Matthew's statement (1918, p. 219) as to the type of *M. necatus* Leidy (1869) being in the American Museum collection was probably a typographical error, as the specimen has never been entered in the Museum's catalogue.

While the length of symphysis is not preserved in any of the Little White River material, the proportions of the several rami and teeth, so far as observable, agree with, or are indistinguishable from specimens from the Ainsworth area. The South Dakota specimens are divided between Size Groups III and IV.

SIZE GROUP III.

FOUR RAMI

Right partial ramus with p_2-m_2 (m_1 and m_2 br.). Marked in (?) Leidy's handwriting, "Little White River" (and on the opposite side), " <i>Merycodus necatus</i> ."	A.N.S.P.11362	From Little White River, Hayden Survey, 1866. This paper, Fig. 43.
Partial right ramus with p_4-m_2 (br.).	A.M.10959	From Little White River, 1903.
Right ramus with symphysis and p_2-m_2 . (m)	A.M.9825	From Little White River, 1902. This paper, Fig. 45.
Right fragment with m_2-m_3 . (This specimen labeled " <i>M. necatus</i> .")	A.N.S.P.11417	From Sweetwater, 18 miles northwest of Devil's Gate, Hayden Survey, 1870. This paper, Fig. 43.

MAXILLA

Right maxilla with p^4-m^2 .	A.M.10958	From Little White River, 1903.
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SIZE GROUP IV. Ten from Little White River.

RAMI

Partial right ramus with p_4 (erupting), m_1 - m_3 (br.).	A.N.S.P.11361	
Right fragment, p_4 - m_3 .	A.N.S.P.11363	
Partial right ramus with p_2 - p_4 alveoli, m_1 - m_3 . (w)	A.M.9825X	1902.
Detached m_2 and m_3 .	A.N.S.P.11363	

Immature and smaller than preceding:

Left fragment, dp_2 - m_2 .	A.N.S.P.11360
Right fragment without teeth.	A.N.S.P.11359
Four detached m_2 s.	A.N.S.P.11359

(And note *Cosoryx* horn fragment, A.M.10966, from the same area—see Horn Section II, page 344.)

(3B) Merycodontini Dentitions from Kansas

Cosoryx furcatus sternbergi, n.subsp., and **R. (Paramoceros) kansanus**, ref.

Figure (in part) 43

The meager available evidence in regard to the Merycodontine dentitions of Kansas consists of two partial mandibles and a skull associated with ramus, of Size Group III, collected by George F. Sternberg in 1933 and 1934. Three forms may possibly be represented, the one having a diminutive and the others a larger p_2 . Unfortunately, all but one of the specimens are greatly worn.

SIZE GROUP II-.

R. (Paramoceros) kansanus, referred

Partial mandible with p_2 - m_2 . (w+) p_2 rather large.	F:A.M.31512	From north fork of Sappa Creek, northwest of Achilles, 1933.
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(See associated partial skeleton, F:A.M.31512, and identical-sized F:A.M. 31512A [this paper, *Fig. 48*], Limb Section IV, page 455; and see type horn, F:A.M.31510, Horn Section II, page 331.)

SIZE GROUP III.

Cosoryx furcatus sternbergi, new subspecies

TYPE.—Partial left ramus with p_2 - m_2 . (w+) (Associated with cranium and horns, see Section II, page 344.)	F:A.M.31511	From Section 1, 2 miles south and $\frac{1}{4}$ mile east of Dinsmore, 1933. This paper, <i>Figs. 43</i> (ramus), <i>28, 28A, 36, 36A</i> (cranium and horns).
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Cosoryx furcatus, Var. p_2 small-proportioned

EXAMPLE.—Right ramus with symphysis and p_2 - m_2 . (M+)	F:A.M.31515	From Republican River Beds, Phillips County, 1934. This paper, <i>Fig. 43</i> .
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(3c) Merycodontini Dentitions from Montana

Cosoryx species

The observed remains from Montana consist of a fragmental mandible with partial cranium bearing horns, from the vicinity of Logan, here made the type of *C. furcatus mooki*, n.subsp., and several ramal fragments in the Marshall collection from a restricted deposit on the Yellowstone River, north of Gardiner, and the original Douglass type from Madison Valley.

SIZE GROUP III.

Cosoryx furcatus mooki, new subspecies

From 10 Miles South of Logan, Montana

TYPE (in part).—Left fragment of ramus, p_2 - m_2 . (w) A.M.21370 Collected by C. C. Mook and C. S. Williams, 1925.

(See associated partial cranium with horns, Horn Section II, page 345. This paper, *Fig. 36A.*)

(?)*Cosoryx agilis* Douglass

From Madison Valley Beds, Montana

TYPE (in part).—Mandible. C.M.703

(See associated partial cranium without horns, Horn Section II, page 346, and associated limbs, Limb Section IV, page 461.)

(?)*Cosoryx* Var.

From the Yellowstone River, Vicinity of Gardiner, Montana

EXAMPLE.—Left immature ramus. Marshall Coll. No. 2
Left ramus with m_2 - m_3 . Marshall Coll. No. 2a

(Recorded, Horn Section II, page 346.)

(4) Merycodontini Dentitions from Nebraska

Figures 44 and (in part) 26, 28A-C, 37, 37A, 40, 45

Pursuant to the general scheme of the Merycodontini section, the mandibular rami from Nebraska are considered first as to area of origin, and second as to form. The majority of the specimens are referred to *Cosoryx* and to *Meryceros*. *Ramoceros*, which so far is evidenced by only a few horns, is not definitely represented by ramal dentitions. Our own collection and that kindly placed at the writer's disposal by Professor E. H. Barbour of the University of Nebraska, include some four hundred and thirty-six listed Merycodontine rami, of which nineteen specimens are definitely associated with upper dentitions.

Cosoryx is known by horn-cores and a large series of miscellaneous remains, all of relatively small size, from Midway Quarry, in larger remains from Gordon Creek, and in occasional specimens from Quinn Quarry and several scattered deposits. Interestingly enough, at neither the Midway Quarry nor Gordon Creek have other than *Cosoryx* horns been observed. The *Cosoryx* rami, with the exception of a few fragmental and indefinitely referable specimens of Size Group IIA, fall into Size Groups III and IV. The specimens from (d) various Brown and Cherry County localities, for convenience of reference, are divided according to variable characters between subsections A-C.

Meryceros is represented by a remarkable series of skulls, horns and mandibular specimens from Nenzel, Crookston and Valentine, etc., all horns from these localities being confined to the one genus. The remains from Nenzel are notably larger than those from Crookston. Notwithstanding the much wider distribution of *Cosoryx*, on account of the wonderful series from Nenzel and Crookston, *Meryceros* is far and away the best represented Nebraskan Merycodontine. The *Meryceros* remains from Nenzel are referred to Size Groups II-III, and those from Crookston, Valentine, etc., to Size Groups III-V.

Paracosoryx is represented by a few partial skulls and possibly as well by certain short-diastramaed rami from Sioux and Dawes Counties. The remains are of relatively small size with short-averaging diastema and are referable (save for a few specimens of Size Group V) to Size Groups III-IV. *Submeryceros* is so far observed alone in the small mandibular rami of Size Group VI from Sioux County.

Ramoceros, as noted under the horn section, is recognized from Nebraska alone in single horns from Hitchcock and Brown Counties, and *Paramoceros* by a single partial cranium, F.A.M.31271, and possibly by rami, F.A.M.31555 and 31551, from Dutch Creek, Brown County.

In the following pages the dentitions are successively and separately listed under:

(4A) BROWN AND CHERRY COUNTIES—*Paramoceros* [horns, sp. (6), p. 330], *Cosoryx* [sp. (3), p. 340] and *Meryceros* [sp. (3, 4 and 4a), pp. 359, 361, 362].

(B) SIOUX COUNTY—*Cosoryx* [no horns], *Paracosoryx* [sp. (13, 14), pp. 351, 353] and *Submeryceros* [no horns].

(C) HITCHCOCK COUNTY—*Cosoryx* [horns, sp. (3j), p. 344] and ?species. (No rami referred: *Ramoceros* [horns, sp. (4), p. 329].)

(D) DAWES-SHERIDAN COUNTIES—*Paracosoryx* [sp. (15), p. 354]. (No rami referred: [sp. (16), p. 354] and *Meryceros* [sp. (4b), p. 367].)

(4A) BROWN AND CHERRY COUNTY LOCALITIES

Paramoceros, *Cosoryx* and *Meryceros*

PARAMOCEROS, NEW SUBGENUS

SIZE GROUP III.

THREE RAMI

With moderately large premolar series

Two from Dutch Creek (*Paramoceros howardæ*):

Partial right ramus with	F:A.M.31555	1929.
p_2 - m_2 . (w+)		

(See associated limb elements, Section IV, page 455.)

Left fragment, m_1 - m_2 . (M+)	F:A.M.31551	1930.
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One from indefinite locality:

Partial right ramus with	F:A.M.31558	1927.
p_2 - m_2 . (w)		

(No trace of p_2 alveolus!)

?Also two specimens of page 419.

PARTIAL SKULL

One from Dutch Creek:

Partial skull with partial	F:A.M.31271	1929.
antlers and m^1 - m^2 . (w++)		

This paper, Figs. 33, 34.

[Type of *R. (Paramoceros) howardæ*, n.sp.—see Horn Section II, page 330.]

COSORYX LEIDY

The available mandibular remains of *Cosoryx* include the fine series of specimens associated with skulls secured in the summer of 1934 from Midway and Gordon Creek Quarries in Cherry County, and a number of tentatively referred specimens from Fort Niobrara and Quinn Quarry.

The finest *Cosoryx* series from a single locality is that secured from the Midway Quarry by Morris F. Skinner, of some one hundred and twenty-four largely complete lower dentitions, some ninety of mature and thirty-four of immature individuals, and almost again as many less complete to fragmentary specimens, and a considerable number of maxillary or partial maxillary dentitions as well as the partial skulls above described. The rami fall into Size Groups III and IV. The symphyseal area is proportionately short and the teeth relatively large. In the smaller specimens the diastemata are moderate, the p_2 - p_3 smaller, the molar ribs less prominent and the crowns perhaps shorter than in the *Meryceros* remains from Crookston Bridge. The anterior premolars are lighter and the diastemata less short than in the more typical remains from Snake Creek. A second series of similar individuals is seen in the remains from Gordon Creek in the University of Nebraska Collection.

The type horn of *Cosoryx* Leidy came from the vicinity of the Niobrara, and as Merycodontine horns from many of the poorly represented Niobrara localities are of *Cosoryx* form, it seems probable that most of the detached rami listed below may belong to that genus. The specimens are generally referable to *C. furcatus* or vars., Size Group III. A few questioned and fragmental specimens of Size Group IIA, on account of the absence of horns of *Meryceros*, are as well held under the former genus. The length of the postsymphysial distance varies from moderately long to long. There are no known specimens with such moderate to short symphysis as met with at Snake Creek. (It is difficult to make a statement re IIA inasmuch as the symphysis is missing, or certain of the premolars are missing, or the teeth are greatly worn, in all the available specimens.) In the well-represented series of Group III are included the questioned variants "x" and "y," and forms with particularly noticeable reduction of the p_2 (see five specimens). There is no evidence of *Cosoryx* or *Meryceros* in the large collections from the stratigraphically high Xmas Quarry. *Cosoryx*, like *Meryceros*, has so far not been definitely encountered in the apparently stratigraphically low Devil's Gulch Quarry.

The mandibular remains from the several Brown and Cherry County localities are detailed in the following pages under:

Cosoryx furcatus LEIDY, REFERRED OR VARS.

- (a) From Midway Quarry, Size Groups III and IV
- (b) From Gordon Creek, Size Groups III and IV
- (c) From Swallow Quarry, Size Groups III and III-
- (d) From various localities, Size Groups IIA, III, III^x, IIIY, IV and Immature, unallocated

(a) FROM MIDWAY QUARRY, 1934 [SIZE GROUPS III AND IV]:

Example, Size Group III by F.A.M. 32354 and Size Group IV by F.A.M. 32362. (See partial skulls and horn-cores, Section II, page 340; and limbs, Section IV, page 458.)

THIRTY-FOUR RAMI

		F.A.M.
Left ramus with symphysis, part of dp_4 (worn) and m_1-m_3 ...	(A)	32338
Right ramus with symphysis, p_3 alveolus and p_1-m_3 (br.)...	(w+)	32339
Right ramus with symphysis, p_2 alveolus and p_1-m_3	(w)	32340
Left ramus with symphysis, p_2-p_3 alveoli and p_4-m_3	(w)	32341
Left ramus with symphysis, p_2 alveolus and p_4-m_3	(w)	32342
Left ramus with symphysis, /Is and /C alveoli, p_1 root and p_1-m_3	(w)	32343
Right fragment with p_1 root and p_1-m_3	(M+)	32344
Left ramus with symphysis, p_2-p_3 alveoli and p_4-m_3	(M+)	32345

F:A.M.		
Right ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3	(M+)	32346
Left ramus with symphysis, p_2 alveolus and p_3 - m_3	(w)	32347
Left ramus with symphysis, p_2 alveolus (br.) and p_3 - m_3	(M+)	32348
Right ramus with symphysis, p_2 alveolus and p_3 - m_3	(w)	32349
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 (anterior ramus heavy-proportioned).....	(w+)	32350
Right ramus with symphysis, /Is, /C and p_2 alveoli, p_3 - m_3 .	(w)	32351
Left ramus with symphysis, /Is, /C and p_2 alveoli and p_3 - m_3 .	(w)	32352
Left ramus with symphysis, p_2 alveolus and p_3 - m_3	(w)	32353
Left ramus with symphysis, /Is and /C alveoli and p_2 - m_3 ..	(w)	32354
Partial left ramus with p_2 - m_3 (m_2 br.).....	(M)	32355
Partial right ramus with symphysis and p_2 - m_3 (br.).....	(w)	32356
Right ramus with symphysis and p_2 - m_3	(w)	32358
Right ramus with symphysis, /Is and /C alveoli and p_2 - m_3 ..	(w)	32359
Right ramus with symphysis and p_2 - m_3	(w)	32360
Left ramus with symphysis, p_2 alveolus and p_3 - m_3	(M)	32361
Smaller:		
Right ramus with symphysis and p_2 - m_3	(w)	32357
Right ramus with partial symphysis and p_2 - m_3 (p_2 small)...	(M+)	32362
Right fragment with p_2 - m_3	(M)	32363
Left fragment with p_2 - m_3	(w)	32364
Left ramus with symphysis, /Is, /C and p_2 alveoli and p_3 - m_3 ..	(M)	32365
Right ramus with partial diastema, p_2 root and p_3 - m_3	(w)	32366
Immature:		
Left ramus with symphysis, 2 /Is erupting, dp_3 - dp_4 and m_1 - m_2 (erupting).....		32370
Right ramus with symphysis, /I erupting, dp_3 - dp_4 and m_1 - m_2 (erupting).....		32371
Right ramus with symphysis, /I erupting, dp_2 alveolus, dp_3 - dp_4 and m_1 - m_2		32372
Right ramus with symphysis, /I erupting, dp_3 - dp_4 and m_1 - m_2 (erupting).....		32373
Left ramus with symphysis, 2 /Is erupting, dp_2 alveolus, dp_3 - dp_4 and m_1 - m_2		32374
Sixty-one mature and twenty-nine immature unlisted rami, F:A.M. Coll.		

SEVEN MAXILLÆ

Left maxilla with p^2 - m^3	(w+)	32383
Left maxilla with p^2 - m^3	(M)	32383A
Left maxilla with p^2 - m^3	(w)	32383B
Right maxilla with p^2 alveolus and p^3 - m^3	(w+)	32383C
Right maxilla with p^2 - m^3	(w)	32383D
Right maxilla with p^3 - m^3	(w)	32383E
Left maxilla with p^4 - m^3	(w)	32383F

Six mature and ten immature unlisted partial upper dentitions and several detached upper teeth, F:A.M. Coll.

(b) FROM GORDON CREEK [SIZE GROUPS III AND IV]:

(See partial crania and horn-cores, Section II, page 341; and limbs, Section IV, page 458.)

THIRTY-FOUR RAMI

Twenty in F:A.M. Collection, 1934:

		F:A.M.
Right ramus with symphysis and p_2 - m_3	(M)	32071
Right ramus with symphysis, p_2 alveolus and p_3 - m_3	(M)	32072
Right ramus with symphysis, incisive alveoli, p_2 alveolus and p_3 - m_3	(M)	32434
Right ramus with broken symphysis and p_2 - m_3	(M)	32437
Left ramus with broken symphysis, p_2 alveolus and p_3 - m_3	(W)	32438
Left ramus with broken symphysis, p_2 alveolus and p_3 - m_3	(M)	32435
Right ramus with broken symphysis, p_2 alveolus and p_3 - m_3	(M)	32436
Right ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3 (br.)..	(W)	32073
Right ramus with symphysis, incisive alveoli and p_2 - m_3	(W++)	32439
Partial right ramus with p_2 alveolus and p_3 - m_3	(M)	32074
Partial left ramus with p_2 - p_3 alveoli and p_4 - m_3	(M+)	32075
Right fragment with p_2 - p_3 alveoli and p_4 - m_3	(M+)	32433
Right ramus with p_2 - p_3 alveoli and p_4 - m_3	(W)	32440
Left fragment with p_2 - p_3 alveoli and p_4 - m_3	(M+)	32078
Partial left ramus with p_2 - p_4 alveoli and m_1 - m_3	(W)	32076
Left fragment with p_4 (br.)- m_3	(M+)	32079
Partial right ramus with p_2 alveolus and p_3 - m_3	(M+)	32077
Left fragment with p_2 - p_3 alveoli and p_4 - m_3	(M)	32080
Left fragment with m_2 - m_3	(M)	32081
Left fragment with m_2 - m_3	(W)	32082

Some seventeen unlisted fragments.

Fourteen in the Nebraska State Museum:

		N.S.M.
Right ramus with symphysis and p_2 - m_3	(M+)	6-31-7-29
Right ramus with symphysis and p_2 - m_3	(M+)	24-19-7-29
Right ramus with symphysis, p_2 alveolus and p_3 - m_3	(W)	10-2-8-29
Left ramus with p_2 alveolus and p_3 - m_3	(W)	7-31-7-29
Partial left ramus with p_2 alveolus and p_3 - m_3	(M)	7-2-8-29
Partial left ramus with p_2 - p_3 alveoli and p_4 - m_3	(M)	9-2-8-29
Partial left ramus with p_2 alveolus and p_3 - m_3	(W)	10-1-8-29
Left fragment with p_3 - m_3 (/ps br.).....	(W)	1-9-8-28
Left fragment with p_2 - p_3 alveoli and p_4 - m_3	(M+)	7-2-8-29
Right fragment with p_2 - m_3	(W)	3-1-8-29
Left fragment with p_2 alveolus and p_3 - m_2	(M+)	2-30-7-29
Right fragment with m_2 - m_3	(M)	8-1-8-29
Right fragment with p_2 - m_3 (teeth broken).....	(A)	1-27-7-29
Right fragment with p_2 - m_1	(M)	11-31-7-29

TEN RAMI, IMMATURE

Six in the F:A.M. Collection, 1934:

Left ramus with symphysis, /I erupting, dp_2 alveolus, dp_3 - m_3 (erupting).....	F:A.M.	32442
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Right ramus with symphysis and dp_2-m_2	F:A.M. 32089
Left ramus with symphysis, incisive alveoli and dp_2-m_2 ..	32443
Partial right ramus with dp_2 alveolus and dp_2-m_2	32090
Partial right ramus with dp_2-dp_3 alveoli and dp_4-m_3 (erupting).....	32091
Immature partial mandible. (See associated partial palate, below.).....	32430
Eleven unlisted immature rami.	

Four in the Nebraska State Museum:

Left fragment with dp_2-m_2	N.S.M. 1-9-8-28
Left fragment with dp_2-m_2	9-29-7-29
Left fragment with dp_2-m_2	1-9-8-28
Right fragment with dp_2-dp_3 alveoli and dp_4-m_3	4-19-7-29

TWO SKULLS AND FOUR MAXILLÆ

One in the Nebraska State Museum:

Partial skull with left horn-core and palate, p^2-m^2 . (See Horn Section II, page 341. [And note partial horn- cores.])	(M) Figs. 36, 36A (horn)	N.S.M. 1-9-8-28
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Five in the F:A.M. Collection, 1934:

Partial right maxilla with m^2-m^3	(M+)	F:A.M. 32087
Left maxilla with p^2-m^3	(M+)	32451
Partial right maxilla with m^1-m^3	(A)	32452
Six maxillary fragments and etc. detached upper teeth, F:A.M. Coll.		
Immature skull with premaxillæ and mandible with /dIs preserved, $dp_2-m_2^2$ and m^3 germ. (Skull broken.) (See Horn Section II, page 341; and see associated limbs, Section IV, page 458.).....	Fig. 26	32450
Immature partial palate. (See associated partial man- dible, above.).....		32430

(c) FROM SWALLOW QUARRY [SIZE GROUPS III AND III-]:

(See partial skulls, Section II, page 342; and limbs, Section IV, page 459.)

FOUR RAMI

Left ramus with diastema and p_2-m_3	(M)	N.S.M. 53-4-7-34
Right ramus with symphysis, /Is and /Cs alveoli, p_2-p_3 (br.) and p_4-m_3	(M)	54-4-7-34
Right ramus with diastema and p_2-m_3	(M+)	24-4-7-34
Partial right ramus with p_2-m_3	(M+)	26-4-7-34

FOUR RAMI, IMMATURE

Left ramus with dp_4-m_2	23-4-7-34
Left ramus with dp_2-m_2	20-4-7-34
Left ramus with dp_2-m_2 (erupting).....	22-4-7-34
Left fragment with dp_2-m_1	29-22-6-34
Ten partial or immature unlisted rami, N.S.M. Coll.	

TWO SKULLS		N.S.M.
Nearly complete skull with left horn base, etc.....		25-22-6-34
Nearly complete skull, ♀, etc.....		3-27-6-34
(See Horn Section II, page 342.)		
MAXILLA		
Left maxilla with p ³ -m ³	(M+)	60-4-7-34

(d) FROM VARIOUS CHERRY AND BROWN COUNTY AND OTHER LOCALITIES [SIZE GROUPS II TO IV].

S.G. III AND IV.

Five from Burge Quarry:

Right ramus, p₄-m₃. (M) F:A.M.32906 This paper, *Fig. 37A*.

Immature left ramus with symphysis, /Is, /C, dp₂ alveoli and dp₃-m₂. F:A.M.32908 This paper, *Fig. 37A*.

Immature right ramus with dp₄-m₃. F:A.M.32904

(See associated cranium, Horn Section II, page 343.)

Left p³-m³. (w) F:A.M.32910

Right p³-m³. (M) F:A.M.32911

S.G. IIIA. Premolars apparently moderate-sized.

(Held here only tentatively as may represent a *Meryceros nenzelensis*-like form.)

Two from Quinn Quarry:

Right fragment with m₂-m₃. (M+) F:A.M.31549 1927.

Left fragment, p₄-m₂. (M+) F:A.M.31552 1927.

S.G. IIIZ. Diastema long, p₂ small.

Cosoryx furcatus, large var. [William B. Scott's "*Cosoryx furcatus*"], from Garman Loup Fork Collection:

Partial mandible with symphysis, p₂-p₄ alveoli, m₁, m₂ alveolus and m₃. M.C.Z.10101 This paper, *Fig. 45*.

(See associated left horn-core, m¹ and skeletal elements, Horn Section II, page 344; Limb Section IV, page 460. And see similar ramus [P.U.12117] from Sioux County, Nebraska, page 429, and *Fig. 45*.)

S.G. IIIV.

Four rami from the Niobrara referred by Leidy (1858, p. 23, and 1869) to *Merycodus necatus* Leidy, in which the molars are said to be much more nearly the form of those of the sheep than of those of the deer or musk.

SEE.—Ramus with p₂ alveolus and p₃-m₃. N.M.5385 Figured by Leidy, 1869, Pl. xiv, Figs. 9, 10. (The missing p₂ replaced.)

p₄, according to figure, measures 6.8 mm., and small versus the Bijou Hills type of *M. necatus* Leidy.

An American Museum ramus (A.M.9825), from South Dakota, appears to be somewhat near to the Leidy figure.

S.G. III.

MANDIBLE

One from Moore Creek:

Nearly complete mandible
with p_2 alveolus and p_3 -
 m_3 . (w)

F:A.M.31274

1929.

This paper, Fig. 45.

(See ?associated pair of horns, F:A.M.31274, referred to *Cosoryx furcatus* Leidy, Horn Section II, page 343.)

TEN RAMI (* = S.G. IV)

Two from Fairfield Creek (possibly of *Meryceros warreni johnsoni*, var., page 423):

Right ramus with sym-
physis, p_2 - p_3 alveoli and
 p_4 (br.)- m_3 (br.). (w+)

F:A.M.31554

1930.

Left fragment with p_2 - p_4
alveoli and m_1 - m_3 . (w)

*F:A.M.31563

1930.

(Compare Fairfield Falls specimen with extremely elongate diastema and reduced premolars under *Plioceros floblairi*, ref., page 496.)

Six from Quinn Quarry:

Partial left ramus with p_2 -
 m_3 (br.). (M+)

F:A.M.31568

1927.

Right fragment with m_1 -
 m_3 . (M)

*F:A.M.31562

1928.

Right fragment with p_4 -
 m_3 . (w+)

F:A.M.31560

1927.

Left fragment, p_4 - m_2 . (M+)

F:A.M.31550

1927.

Right fragment with p_4 -
 m_3 . (w+)

F:A.M.31567

1928.

Right fragment with m_1 -
 m_3 . (M)

F:A.M.31565

1927.

Two from Dutch Creek (probably of *Paramoceros howardæ*, page 413):

Partial left ramus with p_2 -
 m_3 . (M+)

F:A.M.31559

1929.

Fragmental mandible with
 p_4 - m_3 . (M+)

F:A.M.31569

1929.

Twenty-four unlisted partial rami, F:A.M. Coll.

UNALLOCATED IMMATURE SPECIMENS:

SKULL, IMMATURE

Partial skull (crushed)
with dp_4 - m_2 , associated
partial mandible with dp_3 -
 m_2 and germs.

F:A.M.32092

From Elliot Quarry, 1933.

ELEVEN RAMI, IMMATURE

Left ramus with dp_2 - m_2 .

F:A.M.32094

Above Devil's Gulch, 1934.

Partial right ramus with
 dp_3 - m_2 .

F:A.M.32095

From Fairfield Creek, 1928.

Right fragment with dp_3 -
 m_2 (erupting).

F:A.M.32096

From an indefinite locality,
1929.

Left fragment, dp_4 - m_2 .

F:A.M.32097

From ?Quinn Quarry, 1927.

Left fragment with dp_3 -
 m_2 (erupting).

F:A.M.32098

From above north side of
Devil's Gulch, 1933.

Right fragment with dp_1 - m_3 (erupting).	F:A.M.32099	From Dutch Creek, 1929.
Left fragment, dp_2 - m_1 .	F:A.M.32100	Indefinite locality, 1929.
Right fragment, m_1 - m_2 .	F:A.M.31566	Indefinite locality, 1929.
Left fragment with dp_1 - m_2 (erupting).	F:A.M.31553	From above Devil's Gulch, 1934.
Left fragment, dp_2 - m_2 .	N.S.M.2-12-7-28	From Fort Niobrara.
Left ramus with symphysis, /I, dp_2 - m_2 (dp_4 br.).	N.S.M.30-11-8-30	From an indefinite locality.

Sixteen unlisted immature partial rami, F:A.M. Coll.

MERYCEROS, NEW GENUS

Meryceros Size Group II is exemplified in several fine series of specimens from Cherry County, including the large-sized individuals from Nenzel which are suggestive of specimens from New Mexico, and the more moderate-sized individuals from Crookston and Valentine Quarries. A number of dentitions from Brown County are questionably referred to the genus, Size Groups II-III.

Attention has already been called to the remarkable series of crania, several with mandibles attached, and of detached mandibular rami, etc., secured in the summer of 1934 by F. W. Johnson, of the University of Nebraska, at Crookston and here referred to a new subspecies in honor of the discoverer. The horizontal ramus averages long and slender, the diastema elongate and the teeth moderate-proportioned. The specimens are so far indistinguishable from specimens of Snake River and Quarry A, and, with the latter, are referred to Size Groups III-IV. The Crookston series attests to the degree of variation in the size of the teeth, notably of the p_2 , and form of the m_3 heel, that may occur within a series of individuals from a single deposit. The ramus with the longest symphysis is that of an aged male skull (N.S.M.1-23-7-34, m_{+++} , Figs. 28B, 28C); the next longest, in which the teeth are approximately the same size, is that of a mature male skull (N.S.M.3-3-8-34). These two specimens approximate the Valentine Quarry rami exemplified by N.S.M.1-27-8-30 of Size Group IV. More moderate-sized rami are seen in two female skulls (N.S.M.2-9-8-34 and 1-3-8-34), and in the type male skull (N.S.M.2-3-8-34, Figs. 28B, 28C). A considerably slenderer-toothed ramus, in which the lower premolars, particularly p_2 , are notably smaller, is exemplified by ramus N.S.M.7-9-8-34, the same being approximated by Valentine Quarry N.S.M.3-21-7-30, and remains of s.g. v. In the typical *Meryceros* mandible the horizontal ramus is elongate and slender,

the symphysis and diastema are longer, the premolars tend larger and the molar crowns shorter than in *Cosoryx*.

The *Meryceros* dentitions from Cherry and Brown Counties, Nebraska, are listed below, divided between:

- (a) From Nenzel, Cherry County, Size Groups II-III.
- (b) From Brown County, Size Groups IIA-III.
- (c) From Crookston Bridge, Cherry County, Size Groups III-V.
- (d) From Snake River, Cherry County, Size Group III.
- (e) From Valentine Quarry A, Cherry County, Size Groups III^x-IV.

(a) FROM NENZEL, CHERRY COUNTY

Meryceros nenzelensis, new species

The notably large-toothed and heavy-limbed Nenzel form is seen in some sixteen mandibular rami, a number of skulls, including one with mandible attached (see Horn Section II, page 359), and a series of limb elements (see Limb Section IV, page 463), secured by Morris F. Skinner. This Nenzel form, as observed on a preceding page, nearer resembles individuals from Santa Cruz, New Mexico, than the average of *Meryceros* remains from the Nebraska area. Examples of the rami are figured. The rami are listed below under the species based on the horns and crania.

Twenty-seven examples from nine miles south and one mile west of Nenzel on the Niobrara River; Morris F. Skinner, collector, 1934:

SIZE GROUP II.

SIXTEEN RAMI

F:A.M.

Right ramus with symphysis and p_2-m_3 . (See associated skull, Horn Section II, page 360.)	(M++)	31902
Partial right ramus with symphysis and m_1-m_3 .	(W)	32187
Partial right ramus with p_2-m_3 .	(M+)	32188
Left ramus with symphysis, /Is and /C alveoli and p_2-m_3 .	(W)	32169
Left fragment with p_4-m_3 (m_1-m_3 longest).	(M+)	31903
Right fragment with p_2-m_3 .	(W+)	31904
Left fragment with p_2-m_3 .	(M+)	32189
Left fragment with m_1-m_3 .	(W)	31905
Left fragment with p_2 alveolus and p_3-m_2 .	(W)	31906
Right fragment with p_4-m_2 .	(W)	31908
Right fragment with m_1-m_3 .	(W+)	31907
Left fragment with m_3 .	(W)	31910
Eight unlisted fragments, F:A.M. Coll.		

SIZE GROUP III.

Left ramus with symphysis, p_2-p_3 alveoli and p_4-m_3 .	(M)	32171
Partial left ramus with p_2 alveolus and p_3-m_3 .	(M+)	32170
Left fragment with m_3 .	(M+)	31909
Left fragment with p_4-m_1 .	(M+)	31964

RAMI, IMMATURE		F:A.M.
Left ramus with symphysis and dp_2-m_2		32172
Left ramus with symphysis and dp_3-m_2		32173
Right ramus with symphysis and dp_2-m_2		32190
Left ramus with symphysis, /C and I ₃ erupting, dp_2-dp_3 alveoli and dp_4-m_2		32191
Left fragment with dp_2-m_2		32192
Left fragment with dp_3-m_2		32193
Left fragment with dp_4-m_2		32194
Ten fragments of immature rami, F:A.M. Coll.		

FOUR MAXILLÆ		
Right maxilla with p^2-m^2	(M)	31916
Partial left maxilla with m^1-m^2	(W)	31912
Partial right maxilla with detached p^4 and m^2-m^3	(W)	31913
Partial left maxilla with p^4-m^3	(A)	31914
Two unlisted partial maxillæ, F:A.M. Coll. (one not included in specimen count).		

A questionably distinct form is exemplified by a single ramus in which the shortness of the postsymphysis is suggestive of the Sioux County remains:

Left ramus with diastema and p_2-m_3	(M+)	32168
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(b) FROM BROWN COUNTY

(?) *Meryceros* Var., or Vars.

(Certain specimens possibly of *Cosoryx*.)

SIZE GROUP IIA.

FOUR RAMI		
Two from horizon above Devil's Gulch:		
Partial mandible with p_2 alveolus and p_3-m_3 (p_3-m_1 br.).....	(W)	31540
Left fragment with p_2-p_3 alveoli and p_4-m_3	(W+)	31545
One from Williams Canyon:		
Left fragment with p_3-m_1	(M)	31548
One from Rattlesnake Canyon:		
Left fragment with p_2 alveolus and p_3-m_2	(M)	31546

SIZE GROUP III.

SEVEN RAMI		
Three from above Devil's Gulch:		
Partial left ramus with p_2-m_3	(M+)	31544
Right ramus with symphysis, p_2-m_1 and m_3 (br.)....	(M+)	31542
Left fragment with m_1-m_3	(M+)	31547
Three from Deep Creek:		
Partial mandible with p_2 alveolus and p_3-m_3 ; and associated partial left maxilla with p^4 (br.)- m^3 ...	(M+)	31541

Fig. 45

Partial left ramus with p_2-m_3	(w)	1933	F:A.M. 31557
Left fragment with m_1-m_3	(M+)	1933	31564
One from nine miles north of Long Pine:			
Right fragment with p_1-m_3 . (Possibly associated <i>Cosoryx</i> horn fragments, F:A.M.31273, Horn Section II, page 343.)	(w)	1933	31273A

THREE RAMI

With large premolar series

Right ramus with symphysis and p_2-m_3 . (w+)	A.M.8561	Cope Collection. From Fort Niobrara.
(Note intercolumnar styles on m_2-m_3 .)		
Partial right ramus with p_2-m_3 . (M+)	F:A.M.31276	From 45 ft. above Brule Fairfield Creek, 1930.
(Meryceros warreni johnsoni, var. See ?associated pair of horns, Section II, page 366; and limbs, Section IV, page 466. This paper, Fig. 39, horns.)		
(See Valentine Quarry A specimens, page 426, and Fairfield Creek specimens, page 419.)		
Partial right ramus with p_2 alveolus, p_2-m_3 . (w)	N.S.M.1-3-11-13	From Plum Creek.

FOUR MAXILLÆ

One from above Devil's Gulch:		N.S.M.
Right maxilla with p^2-m^3	(A)	2-3-11-13
One from Plum Creek:		
Partial right maxilla with p^4-m^2	(w)	5-3-11-13
Two from Deep Creek:		
Partial left maxilla (listed under associated mandible, see preceding page).....		F:A.M. 1929 31541
Immature left maxilla with dp^3-m^2		1931 32093

(c) FROM CROOKSTON BRIDGE QUARRY, CHERRY COUNTY

Meryceros warreni johnsoni, new subspecies, referred
(See Horn Section II, page 362; Limb Section IV, page 464.)

SIZE GROUPS III-IV.

Specimens collected by the University of Nebraska field party under the leadership of F. W. Johnson, 1935:

TEN MANDIBULAR RAMI

S.G. III.

Mandible with /Is, /Cs and p_2-m_3 . (See associated skull, Horn Section II, page 364.).....	(M+)	N.S.M. 2-15-8-35
Right ramus with symphysis and p_2-m_3	(M++)	12-27-8-35
Right ramus with symphysis and I_2-m_3	(w)	3A-27-8-35
Right ramus with symphysis and p_2-m_3	(M+)	28-15-8-35
Right ramus with symphysis and p_2-m_3	(M+)	33-15-8-35

S.G. IV.

		N.S.M.
Right ramus with symphysis and p_2-m_3	(w)	11-27-8-35
Left ramus with symphysis and p_2-m_3	(M++)	45-5-9-35
Left ramus with symphysis and p_2-m_3	(M++)	43-5-9-35
Left ramus with symphysis and p_2-m_3	(w)	3-27-8-35
Right ramus with symphysis and p_2-m_3	(M+)	29-15-8-35

RAMUS, IMMATURE

Immature ramus with symphysis, /I (erupting) and dp_2-m_3 . (See associated skull, Horn Section II, p. 365.)		10-15-8-35
--	--	------------

Collected by the same party in 1934:

S.G. III-IV.

THIRTY-TWO MANDIBULAR SPECIMENS

Left ramus with p_2-m_3	(w)	30-7-9-34
Left ramus with symphysis, p_2 alveolus and p_2-m_3	(M+)	9-9-8-34
Right ramus with symphysis, /Is and /C broken alveoli and p_2-m_3	(M+)	10-9-8-34
Mandible. (See associated skull, Horn Section II, p. 363.)	(M+++)	3-3-8-34
Mandible. (See associated skull, Horn Section II, p. 364.)	(M++)	7-7-9-34
Fragmental rami. (See associated skull, Horn Section II, page 364.).....		4-3-8-34
Left ramus with symphysis and p_2-m_3	(w)	6-21-8-34
Left ramus. (See associated skull, Horn Section II, page 363. This paper, <i>Figs. 2, 28B, 28C</i> .).....	(M+++)	1-23-7-34
Mandible. (See associated skull, Horn Section II, p. 363.)	(w+)	8-7-9-34
Left ramus with symphysis and p_2-m_3	(M+)	23-7-9-34
Mandible. (See associated skull, Horn Section II, p. 363.)		1-27-7-34
Left ramus with symphysis and p_2-m_3	(M+)	3-23-7-34
Left ramus with symphysis, /Is, /C and p_2 alveoli, p_2-p_4 , m_1 roots and m_2-m_3	(w++)	8-9-8-34
Right ramus with symphysis and p_2-m_3	(w)	4-23-7-34
Left ramus with symphysis and p_2-m_3	(w)	22-7-9-34
Right ramus with symphysis, /Is and /C alveoli, p_2-m_3	(w)	20-7-9-34
Right ramus with symphysis, /Is and /C alveoli and p_2-m_3	(w)	12-3-8-34
Right ramus with symphysis, /Is and /C alveoli and p_2-m_3	(w)	11-9-8-34
Left ramus with symphysis and p_2-m_3	(M+)	10-15-8-34
Left ramus with symphysis, /Is and /C alveoli and p_2-m_3	(w)	8-3-8-34
Left ramus with symphysis, /Is and /C alveoli and p_2-m_3	(M+)	14-9-8-34
Right ramus. (See associated skull, Horn Section II, page 364, and limbs, Section IV, page 464.).....	(M++)	1-3-8-34
Left ramus with symphysis and p_2-m_3	(w)	24-7-9-34
Left ramus with p_2-m_3	(w)	8-15-8-34
Mandible. (Type, in part. See associated skull, Horn Section II, page 363. This paper, <i>Figs. 28B, 28C</i> .)...	(M++)	2-3-8-34
Right fragment with p_2-m_3	(w)	25-7-9-34
Right ramus with symphysis, /Is and /C broken alveoli and p_2-m_3 . (No p_2 alveolus.).....	(M+)	5-23-7-34

		N.S.M.
Right ramus with symphysis and p_2 - m_3	(w)	18-9-8-34
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 . (p_2 held inverted and unerupted within ramus.).....	(M+)	22-9-8-34
Left ramus with symphysis, /Is and /C alveoli and p_2 - m_3 .	(w++)	4-21-8-34
Mandible. (See associated skull, Horn Section II, page 364. This paper, <i>Figs. 28B, 28C.</i>).....	(w)	2-9-8-34
Right ramus with symphysis, p_2 - p_4 , m_1 roots and m_2 - m_3 .	(w++)	6-15-8-34

THIRTEEN RAMI, IMMATURE

Right ramus with symphysis and dp_2 - m_2	23-9-8-34
Right ramus with symphysis and dp_2 - m_2	9-3-8-34
Right ramus with symphysis and dp_2 - m_2	7-21-8-34
Right ramus with symphysis and dp_2 - m_2	16-9-8-34
Right ramus with symphysis, dp_2 alveolus and dp_3 - m_3 (erupting).....	19-7-9-34
Right ramus with symphysis and dp_2 - m_2	21-7-9-34
Left ramus with symphysis, I_2 , /C and dp_2 - m_2	28-7-9-34
Left ramus with symphysis, I_2 , /C (erupting) and dp_2 - m_2 .	34-7-9-34
Right ramus with symphysis and dp_2 - m_2	42-7-9-34
Left ramus with symphysis and dp_2 - m_2	12-15-8-34
Left ramus with symphysis, dp_2 alveolus and dp_3 - m_2	13-9-8-34
Left ramus with symphysis, dp_2 - dp_3 alveoli and dp_4 - m_2 ...	11-3-8-34
Right ramus with symphysis and dp_4 - m_2	7-17-6-32
Numerous unlisted nearly complete or fragmental mature and immature rami, N.S.M. Coll.	

(And note skulls already enumerated under Horn Section II, pages 363-365.)

SIZE GROUP V.

(Small individuals of above species, or distinct var.; p_2 of second specimen disproportionately small.)

TWO MANDIBULAR RAMI

N.S.M.

Left ramus with symphysis and p_2 - m_3	(w)	27-15-8-35
Left ramus with symphysis, /Is and /C alveoli and p_2 - m_3 .	(M+)	7-9-8-34

(d) FROM SNAKE RIVER, CHERRY COUNTY, NEBRASKA

Meryceros warreni johnsoni, referred

SIZE GROUP III.

FOURTEEN RAMI

Larger:

Right fragment with p_4 - m_2	(A)	16-25-6-32
Right fragment with p_3 - p_4 and m_2 - m_3	(w+)	16-25-6-32
Left fragment with m_2 - m_3	(w)	31-25-6-32
Immature partial left ramus with symphysis and dp_2 - m_2 .		22-25-6-32

Smaller:		N.S.M.
Right fragment with p_2 alveolus and p_3-m_3	(M+)	16-25-6-32
Right fragment with p_2 alveolus and p_3-m_3	(M+)	11-8-14
Left fragment with p_3-m_3	(W)	1-15-8-14
Right fragment with p_2-p_3 alveoli and p_4-m_3	(M+)	22-25-6-32
Right fragment with m_2-m_3	(W)	16-25-6-32
Right fragment with m_2-m_3	(M)	16-25-6-32
Left fragment with p_2-p_3	(M)	16-25-6-32
Left fragment with m_3	(M+)	22-25-6-32
Right fragment with p_4-m_1	(M)	31-25-6-32
Left fragment with m_1 , immature.....		16-25-6-32

(e) FROM VALENTINE QUARRY A, CHERRY COUNTY

Meryceros warreni johnsoni, Var.

In the Nebraska State Museum Collection

(And note skulls and horns, Horn Section II, page 366; and limbs, Limb Section IV, page 466.)

30 MANDIBULAR RAMI

SIZE GROUP III ^x .		N.S.M.
Partial right ramus with symphysis and p_3-m_3	(M+)	14-22-8-30
Left fragment with m_1-m_3	(W+)	30-28-7-30
Immature right fragment with symphysis, dp_2 ; p_3 and p_4 (not erupted).....		16-29-7-30

SIZE GROUP IV.

Mandible with symphysis, /Is, /C root and p_2-m_3	(M+)	1-27-8-30
Mandible with symphysis and p_2-m_3 . (p_3 right missing and alveolus closed.).....	(W)	22-2-9-30
Right ramus with symphysis and p_2-m_3	(M)	1-15-7-31
Left ramus with symphysis and p_2-m_3 (br.).....	(M+)	40-22-6-31
Left ramus with symphysis and p_2-m_3	(M+)	20-11-8-15
Right ramus with symphysis and p_2-m_3	(W)	22-28-7-30
Left ramus with symphysis, /Is and p_2-m_3	(W)	2-7-8-30
Left ramus with symphysis and p_2 (br.)- m_3	(W)	15-5-8-30
Right ramus with symphysis and p_2-m_3	(W+)	5-8-8-30
Partial left ramus with p_2-m_3	(M+)	4-21-7-30
Partial left ramus with p_2-m_3	(M+)	1A-15-7-31
Partial right ramus with p_2-m_3	(M+)	79-21-7-31
Partial right ramus with p_2 alveolus and p_3-m_3 . (Note large premolars and different m_3 .).....		16-17-6-32

Slightly smaller:

Partial right ramus with p_2-m_3	(M)	1B-15-7-31
Left ramus with symphysis and p_2-m_3	(M)	1C-15-7-31
Right ramus with symphysis, p_2 alveolus and p_3-m_3	(M)	1D-15-7-31
Left ramus with symphysis and p_2-m_3	(W)	2-6-8-30

(s.g. v):

Left ramus with symphysis and p_2-m_3	(M+)	17-11-8-15
Right ramus with symphysis and p_2-m_3	(M+)	3-21-7-30

		N.S.M.
Right ramus with symphysis and p_2-m_3	(M+)	6-23-8-30
Right ramus with symphysis and p_2-m_3	(M+)	21-21-7-30
Right ramus with symphysis and p_2-m_3 (br.).....	(M)	44-22-6-31
Partial left ramus with p_2-m_3	(M)	7-11-8-15
Partial right ramus with p_2-m_3	(W+)	18-11-8-15
Partial right ramus with p_2-m_3 (br.).....	(W+)	42-22-6-31
Partial right ramus with p_2-m_3	(W+)	10-9-8-30
Right fragment with p_2-m_3	(M+)	11-11-6-34

FIFTEEN RAMI, IMMATURE

Right ramus with symphysis and dp_2-m_2	1-15-7-31
Right ramus with symphysis and dp_2-m_2	17-21-8-30
Partial right ramus with dp_2-m_2	16-17-6-32
Partial left ramus with dp_2-m_2	1-15-7-31
Partial left ramus with dp_2-m_2	22-25-8-30
Partial right ramus with dp_2-m_2	9-9-8-30
Left fragment with dp_4-m_2	1-15-7-31
Left fragment with dp_2-m_2	43-22-6-31
Left fragment with p_2-p_3 and dp_4-m_2 (erupting).....	1-15-7-31
Right fragment with dp_2-m_2	2-26-8-30
Right fragment with dp_2-m_2	16-17-6-32
Left fragment with dp_2-m_2	3-28-8-30
Left fragment with dp_4-m_2	41-22-6-31
Right fragment with dp_2-m_1	16-17-6-32
Right fragment with dp_4-m_1	11-26-8-30

Numerous unlisted mature and immature partial rami, N.S.M. Coll.

Collected by the Morris F. Skinner Party, 1935

S.G. IV.	FIVE MANDIBULAR RAMI	F:A.M.
Left ramus with symphysis and p_2-m_3	(M++)	31182
Left ramus with symphysis and p_2-m_3	(W)	31183
Left ramus with symphysis and p_2-m_3	(M+)	31185
Right ramus with symphysis, p_2 , p_3 alveolus and p_4-m_3	(W+)	31184
Left ramus with symphysis and p_2-m_3 . (S.G. V).....	(M+)	31186
Twenty-six partial mature and immature rami, F:A.M. Coll.		

TWO MAXILLÆ

Left p^2-m^3	(W)	31187
Right p^4-m^3	(W+)	31188

SIZE GROUP IV.

SKULLS

Two male and one female skulls and various horn-cores listed in Horn Section II, page 366. *Figs. 28 and 28A.*

FIVE MAXILLÆ

		N.S.M.
Left maxilla with p^2-m^3	(M+)	5-23-8-30
Partial left maxilla with p^4-m^3	(M+)	84-21-7-31
Partial right maxilla with p^4-m^3	(M+)	26-31-7-30
Partial left maxilla with m^1-m^3	(M)	1-7-6-32
Partial right maxilla with m^2-m^3	(M)	12-22-8-30

(4B) SIOUX COUNTY LOCALITIES

COSORYX LEIDY, PARACOSORYX, N.SUBG., REF., AND SUBMERYCEROS, N.SUBG.

The occurrence of Merycodontini at the Sheep Creek horizon is in question, the evidence as to their presence at best being fragmentary. Matthew (1924) credits *Merycodus* to both the Sheep and Snake Creek, not attempting to distinguish species.

The mandibular specimens from Sioux County, Nebraska (see page 288), are divided between:

Cosoryx furcatus, large var.

EXAMPLE.—Left ramus, P.U.12117. This paper, Fig. 45. (Compare *Plioceros*.)

C. (Paracosoryx) wilsoni, n.subg. and sp.

SUBGENOTYPE.—Partial skull, F:A.M.32470. This paper, Fig. 37.

C. (Paracosoryx) sabulonis (Matthew and Cook)

TYPE.—Right ramus, A.M.14109. This paper, Fig. 44. [Compare *C. (Subparacosoryx) savaronis*, n.subg. and sp. SUBGENOTYPE.—Posterior cranium, A.M.17339. This paper, Figs. 28, 28A. (Skulls only).]

M. (?Submeryceros) minor serpentinus, n.subsp.

TYPE.—Right ramus, F:A.M.31577. This paper, Fig. 44.

The listed F:A.M. and A.M. Sioux County collections include some thirty-six rami with diastema preserved, twenty-seven partial and fragmental rami, five maxillæ and nineteen partial skulls—in addition to three hundred and seventy-one uncatalogued partial and fragmental rami and fifty-one unlisted partial maxillæ. The rami fall in Size Groups III–VI.

Size Group IIIA, *Cosoryx furcatus*, large var., is seen in the Garman Loup Fork specimen (M.C.Z.10101) associated with large horn-core, etc., on which William B. Scott (1890) based his reconstruction of *Cosoryx furcatus*. This form is distinct in the elongation of the diastema and the heaviness and straightness of the ramus, the proportionate smallness of p_2 and resulting shortness of the premolar relative to the molar portion of the series. The form is evidenced at Snake Creek in the lone ramus, here figured (Fig. 45), of the Princeton University Collection (P.U.12117).

Size Groups IIIB and c remains are noteworthy for the extreme shortness and heaviness of the diastema, and are referred to *C. (Paracosoryx) wilsoni*, n.subg. and sp. The teeth generally are extremely heavy-proportioned relative to the size of the ramus though the p_2 may be small. The form is represented by a fine series of mandibular rami and a number of partial crania collected by Jack Wilson and party from Long Quarry. The rami are tentatively subdivided under B and c according to heaviness of the teeth.

Size Group IV rami, exhibiting a moderate-lengthed diastema and relatively large p_2 , as exemplified in the type specimen of *Paracosoryx sabulonis* (Matthew and Cook), are held under that species. It is possible that the latter species may be represented as well by certain small partial crania and horn-cores from the same area. The numerous rami may be divided tentatively into size variations A and B. The actual

postsymphysial distance of twenty measured specimens varies from 25 to 18 mm. The absence of any very notable gap in the series suggests that such differences are largely a matter of individual variation. Comparison of the specimens is complicated on account of tooth wear and the frequently broken condition of the diastema, absence of p_2 , etc. The type ramus (A.M.14109) falls within variation B.

The rare specimens of small Size Group VI are placed questionably in *Submeryceros*. The horns, as noted above, are unknown. Size Group VI, as exemplified in a ramus and referred fragments, exhibits a diastema that tends to be short, but premolars of relatively large size.

Ramoceros is so far unrecognized from Sioux County deposits. (Horns of the genus are indicated alone in Nebraska collections by a horn and horn fragment from Hitchcock County, and a horn fragment from Fairfield Creek, Brown County. *Paramoceros* is known from Nebraska only by the Dutch Creek, Brown County, horn specimen.)

The Sioux County mandibular remains are listed below:

SIZE GROUP IIIA—with long diastema and small p_2 .

Cosoryx furcatus, large var..

RAMUS

Example from Snake Creek area, locality 1000D:

Left ramus with symphysis and p_2 - m_3 . (M+)	P.U.12117	This paper, Fig. 45.
Is very similar to—		
[Partial mandible with symphysis, p_2 - p_4 alveoli, m_1 , m_2 alveolus and m_3 ; left horn-core and possibly associated m^1 , etc.	M.C.Z.10101	Garman Loup Fork collection. Skeleton figured by Scott, 1890, under <i>Cosoryx furcatus</i> referred. This paper, Fig. 45 (ramus).]

(See Horn Section II, page 344; this Section, page 418; and Limb Section IV, page 460.)

SIZE GROUPS IIIB AND C—with short diastema, heavy teeth and reduced p_2 .

C. (Paracosoryx) wilsoni, new subgenus and species, referred

(And see Horn Section II, page 351, and Limb Section IV, page 462.)

VARIATION B. Heavy.

SEVEN RAMI

From Long Quarry, 1934-35:

Right ramus with /Is alveoli and p_2 - m_3	(M)	F:A.M. 32005
Left ramus with /Is alveoli and p_2 - m_3	(M+)	31743
Fig. 37		
Right ramus with /Is alveoli and p_2 - m_3	(M)	31744
Left ramus with /Is alveoli and p_2 - m_3	(W)	31745
Left ramus with /Is and p_2 alveoli, p_2 - m_3	(W)	31746
Right ramus with posterior symphysis, p_2 alveolus and p_2 - m_3	(M)	31747
Right fragment with symphysis, p_2 alveolus and p_2 - m_3	(M)	31748

VARIATION C. Symphysis, compared to B, lighter and p_2 - p_3 larger.

EIGHT RAMI

From Long Quarry, 1934-35:

		F:A.M.
Left ramus with /I and alveoli, p_2 - m_3	(M)	32007
	Fig. 37	
Left ramus with symphysis, /Is alveoli and p_2 - m_3	(M)	32008
Left ramus with p_2 - m_3	(W)	32010
Right ramus with p_2 alveolus and p_3 - m_3	(M)	32011
Right ramus with symphysis, /Is alveoli and p_2 - m_3	(W+++)	32012
Right ramus with p_3 - m_3 and germs.....	(M)	32006
Left ramus with diastema, p_2 alveolus and p_3 - m_3	(-M)	32009
Some one hundred and ninety-five unlisted additional mandibular rami or partial rami from the same locality, F:A.M. Coll.		
Some forty unlisted immature rami or partial rami from the same locality, F:A.M. Coll., including six rami with dp_2 - m_1 (F:A.M.32482, A-E).		
Smaller variation (actually Size Group IV) and suggesting <i>P. sabulonis</i> :		
Left ramus with symphysis, /Is alveoli, p_2 alveolus and p_3 - m_3	(W)	32001

MAXILLÆ

Some seven partial maxillary series.....	32477, A-F
Thirty-one mature and seven immature unlisted partial maxillæ, F:A.M. Coll.	

SIZE GROUPS III-IV.

Paracosoryx sabulonis (Matthew and Cook), referred, or *S. savaronis*, referred

With moderate postsymphysial distance, and relatively large premolars. The series of rami may be divided into two slightly larger and smaller variations, A and B, the type falling into the latter. (See synonymy and referred horns, Horn Section II, page 353; and limbs, Limb Section IV, page 462.)

VARIATION A. (S.G. IV.)

Seventeen from general Snake Creek area:

		A.M.
Right ramus with symphysis and p_2 - m_3	(M+)	26882
Right ramus with symphysis and p_2 - m_3	(W)	26885
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(M)	26880
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(W)	26875
Left ramus with symphysis and p_2 - m_3	(W)	26879
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(W)	26881
Right ramus with symphysis and p_2 - m_3	(W+)	26876
Left ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3 ..	(M+)	26877
Right ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3	(W+) 1908	14110
	Fig. 44	
Left ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(W++) 1908	14103

			A.M.
Left ramus with symphysis and p_2 - m_3 (m_1 br.)....	(w+)	1908	14110A
Left ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3 ..	(w)		26878
Partial right ramus with p_2 - m_3	(M+)	1916	22751
Partial right ramus with p_2 alveolus and p_3 - m_3	(M+)		26883
Partial left ramus with p_2 - m_3	(w)		26887
Partial right ramus with p_2 alveolus and p_3 - m_3	(w)		26886
Partial left ramus with p_2 alveolus and p_3 - m_3	(w+)	1916	22751

Seven from Quarry A, Sinclair Draw:

Right ramus with symphysis, p_2 and m_1 alveoli, p_3 - p_4 and m_2 - m_3	(w+)	1916	22734
Left ramus with symphysis, p_2 - p_3 alveoli and p_4 - m_3 ..	(w)	1921	22743B
Partial right ramus with p_2 - m_3	(M+)	1921	22743C
Partial left ramus with p_2 - m_3	(w)	1921	22743D
Left fragment with p_2 - m_3	(M)	1921	22743E
Partial right ramus with p_2 alveolus and p_3 - m_3	(w+)	1921	22743A
Left fragment with p_2 - p_3 alveoli and p_4 - m_3 . (Note "heel" m_3).)	(w)	1921	22743

Two from Quarry B:

Partial right ramus with p_2 - m_3	(M)	1921	22744
Left fragment with p_3 (br.)- m_3 . (Note larger, and "heel" m_3).)	(w+)	1921	22744A

Heavier variation (Size Group III)—towards *P. wilsoni*, var. B:

Two from general Snake Creek area:

Right ramus with symphysis and p_2 - m_3	(w)		26890
Left ramus with symphysis, /I, p_2 alveolus, p_3 - m_3 ..	(A)		26891

Two from vicinity of Stonehouse Draw:

Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(M)	1923	20530
	Fig. 44		
Right fragment with p_3 - m_3	(w)	1923	20530X

VARIATION B. (SIZE GROUP IV.) (Symphysis slighter.)

Six from general Snake Creek area:

Right ramus with symphysis and p_2 - m_3 . (M+)	A.M.14109	1908.	
[Type of <i>P. sabulonis</i> (Matthew and Cook).]		Figured by Matthew and Cook, 1909, Fig. 24; this paper, Fig. 44.	A.M.
Right ramus with symphysis, p_2 - p_3 alveoli, p_4 - m_3 ..	(w)	1908	14105
Partial right ramus with p_2 - m_3	(M+)	1908	22409
Left ramus with partial symphysis and p_2 - m_3	(M+)	1916	22735
Partial left ramus with p_2 - m_3	(M+)	1916	22751
Partial right ramus with p_2 root and p_3 - m_3	(M)		26884

One from Quarry No. 6, Lower Snake Creek:

Right ramus with partial symphysis and p_2 - m_3	(M+)	1926	22065
	Fig. 44		

Variation (from Quarry B), larger and questioned—teeth towards *P. wilsoni*,
Size Group III, var. c: A.M.

Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(A)	1921	22739
Right ramus with symphysis, p_2 alveolus and p_3 - m_3 ..	(A)	1921	22740

One hundred and thirty mature and six immature unlisted partial rami from general Snake Creek area.

MAXILLÆ

Six from Snake Creek area:

Posterior half of skull with horns and partial right maxilla with m^1 - m^3 .	A.M.17339	1916. Figured by Matthew, 1918, Fig. 18; this paper, <i>Figs.</i> 28, 28A.
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(Type of *Subparacosoryx savaronis*, n.subg. and sp. See Horn Section II, page 353.)

Right maxilla, p^2 - m^2 . (w)	A.M.26889	
Right maxilla, p^2 - m^2 . (w)	F:A.M.31388	
Left maxilla, p^4 - m^3 . (M+)	A.M.22736	Quarry B, 1921.
Right maxilla, m^1 - m^2 . (M+)	A.M.22737	Quarry B, 1921.
Left maxilla with dp^2 - m^2 .	A.M.20530	Vicinity of Stonehouse Draw, 1923.

Six unlisted maxillæ and numerous detached teeth.

SIZE GROUP V. Tentatively referred to these species.

FOUR RAMI

Partial right ramus with p_2 - m_3 . (w)	A.M.26888	From Snake Creek area.
Left ramus with p_2 - p_3 alveoli and p_4 - m_3 . (w)	F:A.M.32833	Vicinity of Greenside Quarry, 1935.
Right fragment with m_1 (br.)- m_3 .	P.U.12133	From locality 1000D.
Right fragment with m_2 - m_3 .	F:A.M.31576	From Quarry No. 7, W. Sinclair Draw.

UNALLOCATED IMMATURE SPECIMENS:

RAMI, IMMATURE

Fourteen from Snake Creek area:

Left fragment with dp_2 (root)- m_2 (erupting).	F:A.M.31578	Antelope Draw, 1933.
Right ramus with symphysis, p_3 , dp_4 , m_1 - m_3 (erupting) and p_4 germ.	A.M.22741	Quarry B, 1921.
Left ramus with symphysis and dp_4 - m_3 (erupting).	A.M.22744	Quarry B, 1921.
Right fragment with dp_2 - m_3 (erupting).	A.M.14107	1908.
Right fragment with dp_3 - m_3 (erupting).	A.M.22743	Quarry A, 1921.

Left fragment with dp_3 - m_3 (erupting).	A.M.22742	1921.
Right ramus with dp_3 - m_1 .	A.M.22747	1916.
Right ramus with symphysis and dp_4 - m_1 (erupting).	A.M.22747	1916.
Left fragment with dp_4 - m_3 (erupting).	A.M.14102	1908.
Right fragment, dp_3 - m_1 .	A.M.22744	Quarry B, 1921.
Left fragment, dp_3 - m_1 .	A.M.22752	Quarry A, 1921.
Right fragment, dp_3 - m_1 .	A.M.20530	Stonehouse Draw vicinity, 1923.
Left fragment, dp_3 - m_1 .	A.M.22751	1916.
Left fragment, dp_3 - m_1 .	A.M.21473	Olcott Hill, 1925.

SIZE GROUP VI.

(?)*Submeryceros minor serpentinus*, new subspecies

Diastema moderately short, premolars relatively large

TYPE.—Right ramus with symphysis and p_2 - m_3 . (M) F:A.M.31577 From E. Sinclair Draw, 1933. This paper, *Fig. 44*.

FOUR RAMI, ETC., TENTATIVELY REFERRED.—

One from vicinity of Stonehouse Draw:			A.M.
Left fragment with p_4 (br.)- m_2	(w)	1923	20530A
One from Thistle Quarry:			F:A.M.
Left p_4 - m_3	(M+)	1935	31571
Two from general Snake Creek area:			A.M.
Right fragment with m_3	(M)	1916	22749
Detached m_2 and m_3		1916	22749

(4C) HITCHCOCK COUNTY LOCALITIES

SIZE GROUP III.

Cosoryx furcatus Leidy, referred

Partial ramus. A.M.8497 From Driftwood Creek, 1879.
Cope Collection.

(See top of cranium and horns under same number, Section II, page 344.
This paper, *Figs. 28, 36.*)

Merycodontine species, referred

Right ramus with partial A.M.8499 Cope Collection.
symphysis, p_2 alveolus
and p_3 - m_3 . (M+)

Teeth seemingly taller and heavier, and symphysis longer than in Snake
Creek, Size Group III.

Left ramus with symphysis and dp_2 - m_1 N.S.M. 9-4-29
Right ramus with symphysis and m_1 9-4-29

(4D) DAWES COUNTY (GINN QUARRY)

SIZE GROUP IV.

C. (Paracosoryx) dawesensis, n.sp., referred

FOUR RAMI

Right mandibular ramus with diastema and p_2 (br.)- m_3 . (w+) F.B:A.M. 32854
Three immature rami with dp_2 - m_1 32854A-C

TWO MAXILLÆ

Left maxilla with p^2 - m^2 (M) 32853
Left p^2 root- m^3 (W) 32853A
(See Horn Section II, page 354.)

SIZE GROUP VI.

(?) *Submeryceros minor serpentinus*, var.

EXAMPLE.—Right ramus with p_1 - m_3 and alveoli..... (M) 33779

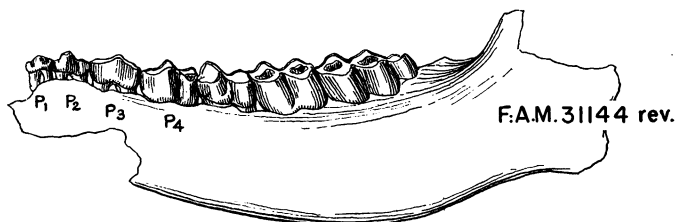


FIG. 47A. *R. (Merriamoceros) coronatus* (Merriam), ref., rev. (F:A.M.31144), from Upper Steepside Quarry, Barstow, California. [Specimen unique in presence of p_1 (dp_1).]

× 1. (See page 437.)

(5) Merycodontini Dentitions from California

(5A) BARSTOW LOCALITIES

Merriamoceros, Paracosoryx and Meryceros species

Figures 46, 47A and (in part) 35A, 47

Merycodontine partial mandibles and detached teeth occur from top to bottom of the Barstow deposits. The present collection contains some one hundred and twenty-eight listed rami, forty-one listed partial maxillæ, two hundred and forty-two unlisted partial rami, thirty-nine unlisted partial maxillæ and numerous fragments. Were the diastemata and the p_3 s more generally preserved, the task of determining the number of forms present might be simpler. The rami, compared with those from New Mexico, are shallower and have slenderer-compressed molars, with less noticeably elongate crowns. Definite comparison may be made only in the case of specimens with unworn m_3 s. Size Group II (single specimen) and Size Groups III, IV and V are present. There is the usual difficulty in allocation of particular rami through overlap, the smallest specimens of Size Group III being approximated by the largest of Size Group IV.

The relative frequency of occurrence of horns and dentitions suggests the allocation of the Barstow dentitions to *Paracosoryx* and *Meryceros*. As *Paracosoryx* horns are encountered so far only in several restricted quarries, the commoner of the rami from the same localities, which happen to exhibit a relatively moderate diastema and small p_2 , are referred to this subgenus. *Meryceros* horns occur only in certain First Division localities, and the subgenus is thought to be represented by ramal specimens from the same localities that have a relatively moderate symphysis and large-tending p_3 - p_4 . (*Paramoceros*, based on horns of rare occurrence from the Green Hills, is probably unrepresented by ramal remains.) *Merriamoceros* is witnessed by a recently secured series of rami with short diastema and large-proportioned p_2 of Size Group III to III-. The specimens were obtained, together with a fine collection of horns, from the Steepside Quarry in the Green Hills, Barstow. The mandibular characters recall smaller individuals of *Paracosoryx* from Sioux County, Nebraska. (One unique specimen retains the p_1 .)

Thus specimens from the Mojave, unlike those from New Mexico and northern Nebraska, include evidence of forms with short-proportioned diastema, such as occurs among the Sioux County, Nebraska, remains.

Size Group II is exemplified by a partial ramus from an indefinite horizon.

Size Group III is represented by:

Specimens from Steepside Quarry in the Green Hills, see above.

Rami from Skyline and New Year Quarries that exhibit relatively short premolar versus molar series and moderately long diastemata.

Small Skyline F:A.M.31042 closely resembles New Year F:A.M. 32043. The rami are believed to represent the same *Paracosoryx* as seen in the horns from these quarries.

Specimens from Hemicyon Stratum, North End, White Operation, Leader and Hidden Hollow Quarries tend to taller crowns. Specimen F:A.M.31054, Hemicyon Stratum, is larger and has relatively larger p_3 - p_4 than most specimens from this locality. It is apparent that the difference in crown height is due in measure to age—and more unworn dentitions are needed. The specimens of this paragraph are believed to represent *Meryceros joraki*, the horns of which occur at the same localities.

A ramus from Manix (F:A.M.31027) that is unique in its notably reduced p_3 - p_4 and prominent m_3 talonid.

Rami from the Green Hills, certain of which exhibit a p_3 - p_4 that seem large relative to the molars (F:A.M.31057, 31062, 31061, 31064).

Size Group iv is exemplified by specimens with a premolar-molar series of apparently average proportions and diastema of moderate length, from the First, Second, Third and Fourth Divisions.

Size Group v is well represented in the Barstow area, Third Division. The premolars are large relative to the molars (the lower premolars being larger-proportioned than in Size Group iv).

Unfortunately the examples from the various localities which exhibit larger and smaller premolars, except in a few cases, have the diastema incomplete. Were the Barstow specimens better preserved it is possible that the same might generally be subdivided, as in the case of certain Green Hills specimens (Size Group III F), between specimens with smaller premolars and longer-tending diastema (F:A.M.31055 and 31056) and specimens with larger premolars and shorter-tending diastema (F:A.M. 31057 and 31059). A similar variation occurs in the case of certain Steep-side Quarry specimens (Size Group III, F:A.M.31038 having shorter diastema and larger premolars than F:A.M.31019). Smaller specimens with relatively small premolars and larger specimens with relatively large premolars (diastema lacking) may be cited in the case of several localities, as follows:

EXEMPLIFIED FROM:	SIZE GROUP	(A) WITH SMALL PREMOLARS	(B) WITH LARGER PREMOLARS
		F:A.M. NUMBER	F:A.M. NUMBER
Skyline Quarry.....	IIIA	31041	31040
New Year Quarry....	IIIAA	32034 32045 32043	32042
Hemicyon Stratum...	IIIB	31071 31073	31072 31076
White Operation.....	IIID	31053	31049
Valley View Quarry...	IVA	31090	31092
Second Division.....	IVB	31089	31096
Third Division.....	IVC	31095 31094	31063 31081

The Barstow dentitions, including some one hundred and twenty-eight rami and forty-one maxillary specimens (exclusive of unlisted fragments), may be listed according to locality and size groups, as follows:

SIZE GROUP II—represented by a single fragment from an indefinite area.

			F:A.M.
Left fragment with p_4-m_3	(w)	1923	31026

SIZE GROUP III—is relatively common and includes examples of *Merriamoceros*, *Paracosoryx* and *Meryceros*.

III— TO *IV.

R. (Merriamoceros) coronatus (Merriam), referred

Eleven from Steepside Quarry, 1936:

	RAMI		F:A.M.
Right ramus with symphysis and p_2-m_3	(w)		*31019
	Fig. 35A		
Right ramus with diastema and p_2-m_3	(M)		31020
	Fig. 35A		
Left ramus with posterior symphysis and p_2-m_3	(w+)		31019E
Right ramus with symphysis and p_2-m_3	(w)		31038
Left ramus with symphysis, p_2 alveolus and p_3-m_3	(M+)		31038A
Left ramus with symphysis, p_2 alveolus and p_3-m_3	(M+)		*31019F
Left ramus with symphysis and p_2 (br.)- m_3	(w++)		31019D
Right ramus with p_2 , p_3 (br.) and p_4-m_3	(w)		*31019G
Right ramus with posterior symphysis, p_2 root, p_3-m_3 (br.)..	(w+)		31019C
Left ramus with p_2-m_3	(M+)		31019A
Left ramus with p_2-m_3	(w+)		31019B

Seventy-one fragmental rami and twenty-five partial maxillæ, F:A.M. Coll.

Right ramus with p_1-m_3 (collected 1937, not included in count).....	(w)		31144
	Fig. 47A		

III A.

C. (Paracosoryx) alticornis, n.sp., referred

Fourteen from Skyline Quarry:

ELEVEN RAMI

Larger:

Left ramus with symphysis, p_2 alveolus and p_3-m_3	(M+)	1933	31040
Right fragment with p_3-p_2 alveoli and p_4-m_3	(w)	1933	31044
Left fragment with m_1 (br.)- m_3	(w)	1933	31039
Left fragment with m_1-m_3	(w+)		31028

Smaller:

Left ramus with symphysis, p_2 alveolus and p_3-m_3 (br.).....	(M)	1933	31041
	Fig. 47		
Partial mandible with p_2 alveolus and p_3-m_3	(M+)	1933	31042
Partial left ramus with p_2-m_3	(M+)	1933	31043
	Fig. 47		

			F:A.M.
Right fragment with p_2 alveolus, p_3 (br.)- m_3 (br.).	(w)	1933	31045
Right fragment with p_3 (br.)- m_3	(w)	1933	31046
Partial right ramus with m_3	(M)	1933	31047
Left fragment with p_2 - m_3	(w)	1933	31048
Ten unlisted partial rami, F:A.M. Coll.			

THREE MAXILLÆ

Left maxilla with p^2 - m^3	(w)	1932-33	32024
Right maxilla with p^4 - m^3	(w)	1932-33	32025
Right maxilla with p^4 - m^2	(w)	1933	32026
Two unlisted immature partial maxillæ, F:A.M. Coll.			

IIIAA-.

(?)*C. (Paracosoryx) alticornis*, var. (or *Cosoryx* species)

Thirteen from New Year Quarry, 1934 (/ms tending small):

ELEVEN RAMI

Partial right ramus with p_1 - m_3 . (See right maxilla below.).	(M+)	32034
Partial left ramus with p_2 - m_3	(M+)	32042
Partial right ramus with p_1 - m_3	(M)	32043
Partial right ramus with p_2 alveolus, p_3 - m_3	(w)	32044
Right fragment with p_2 - m_3 (m_1 br.).....	(M)	32045
Right fragment with p_2 alveolus, p_3 - m_3	(W+)	32046
Right fragment with p_4 - m_3	(A)	32047
Right fragment with p_2 alveolus, p_3 - m_3	(M)	31068
Right fragment with p_4 - m_3	(A)	31069
Left fragment with p_3 - m_3 (m_1 and m_3 br.).....	(M+)	32040
Right fragment with p_3 (br.)- m_3	(M+)	32041
Three unlisted partial rami, F:A.M. Coll.		

FOUR MAXILLÆ

Partial left maxilla with p^2 - m^3	(A)	32035
Partial right maxilla with p^2 - m^2	(A)	32036
Right maxilla with p^2 - m^3 . (See right ramus above.).....	(M+)	32034

One from First Division, 1924:

Partial left maxilla with m^2 - m^3	(M+)	31819
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IIIB-EEE. *Meryceros joraki*, n.sp., referred (in part)

IIIB.

Nineteen from the Hemicyon Stratum:

ELEVEN RAMI

Larger:

Left fragment with p_2 - m_3 (with larger p_4).....	(M)	1930	31054
	Fig. 47		
Partial left ramus with p_2 - p_3 alveoli and p_4 - m_3 (m_3 , m_3 br.).....	(M)	1931	31072
	Fig. 47		
Right fragment with m_2 - m_3	(M+)	1924	31030
Right fragment with m_2 (br.)- m_3	(w)	1926	31031

Right fragment with p_4-m_3	(M+)	1927	F:A.M. 31075
Right fragment with m_2-m_3 (br.).....	(W+)		31078
Smaller (possibly Size Group IV):			
Partial right ramus with p_2 alveolus and p_3-m_3	(M+)	1931	31071
Right fragment with p_2 alveolus and p_3-m_3	(M)	1926	31073
Right fragment with p_3-m_3	(M)	1926	31074
Left fragment with p_4-m_3	(M+)		31076
Right fragment with p_4 (br.)- m_3	(W)	1926	31077

SKULL

Major portion of skull with dentition and right horn.	(W)	1926	31163
(Type of <i>Meryceros joraki</i> , n.sp.—see Horn Figs. 23, 23A Section II, page 368.)			

SEVEN MAXILLÆ

Left maxilla with p^2-m^2	(M+)	1926	31820
Left maxilla with p^2-m^3	(M)		31821
Left maxilla with p^3-m^3	(M+)	1930	31822
Right maxilla with p^2-p^4 and m^2-m^3	(W)	1926	31823
Right maxilla with p^4-m^3	(M)	1923	31824
Right maxilla with p^4-m^3	(M)	1923	31825
Left maxilla with dp^3-m^2		1926	31826

IIIc.

Nine from North End (IV*):

FIVE RAMI

Partial right ramus with p_2 alveolus and p_3-m_3	(M)	1931	*31032
	Fig. 46		
Partial right ramus with p_2 alveolus and p_3-m_3	(M+)	1930	*31033
Left fragment with p_4-m_3	(M)	1930	31034
Left fragment with p_4-m_3	(M)	1931	*31035
Left fragment with p_3-m_3	(M+)	1931	31036
	Fig. 46		

FOUR MAXILLÆ

Partial palate with p^4-m^2	(M+)	1930	32020
Right maxilla with p^2-m^3	(A)	1931	32021
Right maxilla with m^1-m^3	(W)	1930	32022
Left maxilla with p^4-m^3	(W)	1930	32023

IIId.

Twelve from White Operation:

FIVE RAMI

Larger:

Left ramus with symphysis, p_2-p_3 alveoli and p_4-m_3	(M+)	1930	31049
	Fig. 47		
Right fragment with p_2 alveolus, p_3-m_3	(M+)	1927	31050
	Fig. 47		
Partial right ramus with p_2 (br.)- m_3 (m_1 br.).....	(W)	1930	31051

Left fragment with p_1-m_3	(w)	1930	F.A.M. 31053
Smaller:			
Left fragment with p_1-m_3	(M+)	1927	31052
SEVEN MAXILLÆ			
Partial palate with p^3-m^2	(w)		32027
Left maxilla with p^4-m^3	(w)		32028
Right maxilla with m^2-m^3	(M+)		32029
Right maxilla with m^2-m^3	(W+)		32030
Left maxilla with m^1-m^3	(w)	1927	32031
Right maxilla with m^2-m^3	(w)	1927	32032
Right maxilla with m^2-m^3	(w)	1927	32033

III.E.

Seventeen from Leader Quarry, 1935, collected by Jack Wilson's party:

ELEVEN RAMI

Larger:

Left fragment with p_2 alveolus and p_1-m_3 (br.).....	(A)	32801
Right fragment with p_4-m_3	(A)	32801A
Left fragment with p_1-m_3 (br.).....	(W+)	32801B
Right fragment with p_1-m_3	(W+)	32802C
Left fragment with p_1-m_3	(W+)	32802E

Smaller:

Left fragment with p_1-m_3	(w)	32802
Right fragment with p_2-p_3 alveoli and p_4-m_3 (br.).....	(M)	32802A
Left fragment with p_4 (br.)- m_3	(M)	32802B
Left fragment with p_1-m_3	(M)	32802D
Right fragment with p_4-m_3	(M)	32802F
Right fragment with p_2 alveolus and p_1-m_3	(M)	32803

SIX MAXILLÆ

Left maxilla with p^2-m^3	(M)	32805
Right maxilla with p^2-m^3	(w)	32805A
Left maxilla with p^3-m^3	(M+)	32805B
Left maxilla with p^3-m^3	(M)	32805C
Left fragment with p^3-m^2	(A)	32805D
Left fragment with p^4-m^3	(M+)	32805E

III.EE.

RAMI

Two from Hidden Hollow Quarry, 1935, collected by Jack Wilson's party:

Right ramus with symphysis and p_1-m_3	(w)	31845
Left fragment with p_1-m_3	(M)	31846

IIIEE.

One from the vicinity of Manix:

Right fragment with p_2 alveolus and p_3 - m_3 . (Note "heel" of m_3).....	(w)	1932	F:A.M. 31027
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IIIF. (*Meryceros joraki*, var.)

Twenty-two from the Green Hills:

EIGHTEEN RAMI

Larger:

Left fragment with p_2 - m_3	(w+)	1931	31029
--	------	------	-------

Smaller:

Mandible with symphysis, p_2 , p_3 alveolus and p_4 - m_3 .	(M+)	1930	31055
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Fig. 47

Right ramus with symphysis, p_2 alveolus and p_3 - m_3	(M+)	1931	31056
--	------	------	-------

Fig. 46

Right ramus with symphysis and p_3 - m_3	(M+)	1931	31057
--	------	------	-------

Fig. 47

Right ramus with symphysis and p_3 - m_3	(w+)	1931	31058
--	------	------	-------

Partial left ramus with p_2 alveolus, p_3 and m_1 - m_3 ..	(M)	1930	31059
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Right fragment with p_3 - m_3	(M+)	1929	31060
---	------	------	-------

Right fragment with p_3 - m_3	(M+)	1930	31061
---	------	------	-------

Left fragment with p_3 - m_3	(M+)	1931	31062
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Left fragment with p_4 - m_3 (m_1 br.).....	(w)	1930	31064
--	-----	------	-------

Right fragment with p_4 (br.)- m_3	(w+)	1930	31065
--	------	------	-------

Left fragment with p_4 - m_3	(w+)	1930	31066
--	------	------	-------

Left fragment with m_3 - m_3	(w+)	1930	31067
--	------	------	-------

Partial left ramus with p_2 alveolus and p_3 - m_3	(M+)	1930	31084
--	------	------	-------

Left fragment with p_3 - m_3	(M+)	1930	31085
--	------	------	-------

Right fragment with p_3 - p_3 alveoli and p_4 - m_3 (br.)....	(M+)	1930	31086
---	------	------	-------

Partial left ramus with p_3 - p_3 alveoli and p_4 - m_3 (br.)..	(A)	1930	31087
---	-----	------	-------

Right fragment with m_1 - m_3	(A)	1928	31088
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FOUR MAXILLÆ

Larger:

Right maxilla with p^2 - m^2	(M)	1930	31812
--	-----	------	-------

Left maxilla with p^4 - m^2	(M+)	1930	31813
---------------------------------------	------	------	-------

Smaller:

Right maxilla with p^2 - m^2	(M)	1932	31814
--	-----	------	-------

Right maxilla with p^4 - m^2	(M+)	1932	31815
--	------	------	-------

SIZE GROUP IV—is well represented by mandibular specimens here referred tentatively to *Meryceros joraki* (A-D); and to (?)*Merriamoceros coronatus*, var. (E):

A.

RAMI

Three from Valley View Quarry:

Partial right ramus with p_2 alveolus and p_3 - m_3	(M)	1933	31090
--	-----	------	-------

Fig. 46

		F:A.M.	
Partial left ramus with p_2-m_3	(w)	1933	31092
Right fragment with p_2-p_3 alveoli and p_4-m_3 (br.)....	(m)	1933	31091
B.			
Five from Second Division:			
Mandible with symphysis and p_2-m_3	(M+) <i>Fig. 46</i>	1928	31079
Left fragment with p_4-m_2 . (See possibly associated horn referred to <i>Meryceros joraki</i> , n.sp., Horn Section II, page 369. This paper, <i>Fig. 39</i> .).....	(w+)	1927	31162
Left fragment with p_2 alveolus and p_3-m_3 (br.).....	(w)	1927	31089
Left fragment with p_2 alveolus and p_3-m_3	(m)	1928	31096
Left fragment with p_3 alveolus and p_4-m_3 (br.).....	(M+)	1928	31063
MAXILLÆ			
Two from indefinite locality:			
Right maxilla with m^1-m^3	(M+)	?1932	31817
Left maxilla with m^1-m^3	(M)	1931	31818
C.			
RAMI			
Three from Third Division:			
Right ramus with symphysis, p_2-p_3 alveoli and p_4-m_3	(w+)	1926	31080
Right fragment with p_2-p_3 alveoli and p_4-m_3	(M+)	1926	31081
Right fragment with p_3-m_3 (br.).....	<i>Fig. 46</i> (w)	1926	31082
D.			
MANDIBLE			
One from Fourth Division:			
Partial mandible with p_4 (br.)- m_3	(w) <i>Fig. 46</i>	1929	31083
E.			
RAMI			
Two from Yermo Quarry:			
Right fragment with m_2-m_3	(w)	1932	31093
Right fragment with dp_3-m_1		1932	31098I
One hundred and fifty-eight mature and immature unlisted partial rami, twelve unlisted partial maxillæ and numerous smaller fragments, F:A.M. Coll.			

SIZE GROUP V. (Tentatively referred to *M. joraki*, may represent separate form.)

RAMAL FRAGMENTS

Three from Third Division, 1926:		F:A.M.
Left fragment with p_3 - m_3	(w)	31094
Left fragment with p_3 - m_3	(M+)	31095
	Fig. 46	
Right fragment with p_3 alveolus and p_4 - m_3 (br.).....	(M+)	31097

SIZE GROUPS III-V.

TWENTY-THREE RAMI, IMMATURE

(?)*C. (Paracosoryx) alticornis*, n.sp., referred

Five from Skyline Quarry, 1933:

Left fragment with dp_1 - m_2	31098C
Partial right ramus with dp_3 - m_1	31098D
Right fragment with dp_2 - m_1	31098E
Right fragment with dp_4 - m_1	31098F
Left fragment with dp_4 - m_1	31098G

One from May Day Quarry, 1934:

Partial left ramus with dp_2 - m_1	31098H
--	--------

(?)*C. (Paracosoryx) alticornis*, var., referred

Six from New Year Quarry, 1934:

Left ramus with symphysis and dp_2 - m_1	31099F
Partial right ramus with dp_3 - m_1	31099G
Partial left ramus with dp_2 - m_1	31099H
Partial right ramus with dp_4 - m_1	31099I
Right fragment with dp_4 - m_1	31099J
Right fragment with dp_2 - m_1	31099K

(?)*Meryceros joraki*, n.sp., referred

Five from White Operation, 1927:

Right fragment with dp_4 - m_1	31099A
Right fragment with dp_2 - m_1	31099B
Right fragment with dp_2 - m_1	31099C
Right fragment with dp_4	31099D
Left fragment with dp_4 - m_1	31099E

Four from Leader Quarry, 1935 (approximating Size Group III):

Right fragment with dp_3 - m_2 (erupting).....	32804
Left fragment with dp_3 - m_1	32804A
Two smaller fragments.....	32804B, C

Two from Lower Green Hills, 1931:

Right fragment with dp_3 - m_2	31098A
Left fragment with dp_4 - m_2	31098B

MAXILLA, IMMATURE

One from the Green Hills, 1930:

Left maxilla with dp^4 - m^3	31816
--	-------

(5B) RICARDO PLIOCENE LOCALITIES

C. (*Paracosoryx*) *furlongi*, referred

(See synonymy under same, Horn Section II, page 348)

Figure (in part) 47

The type of the above species is a skull in the collection of the University of California (see p. 349). The several here listed fragments were collected by Joseph Rak while passing through Ricardo Canyon, November 15, 1923. The specimens (see unworn m_3 , F:A.M.31859) differ from the earlier remains from Barstow in the greater height of the crowns. The p_4 (see unworn fragment, F:A.M.31857) seems to have been very large.

SIZE GROUP III.

	RAMI		F:A.M.
Right fragment with m_2 - m_3		(w)	31856
Right fragment with p_4 - m_1		(M)	31857
Left fragment with m_1 - m_3		(M+)	31855
Detached right m_3	Fig. 47	(M)	31859
Detached right m_3		(M+)	31858

Immature:

Left fragment with dp_4 - m_1	31860
Right fragment with dp_4	31860B

SKULL

TYPE.—Partial cranium with tall horn-cores, max- illary series, ramus, etc.	U.C.26795	Figured by Furlong, 1927, Pl. xxiv, Fig. 3; Pl. xxvi, Fig. 1; and Pl. xxvii, Fig. 4.
(See associated metatarsus, Limb Section IV, page 462.)		

FIG. 48. Late Tertiary Antilocapriini and Merycodontini, relative size of metapodials.

× $\frac{1}{2}$. Brackets indicate limbs assigned to a single species.

Col.M.219, (?) *Texoceros vaughani*, questionably ref., right metatarsus, from Yuma County, Colorado.

(See Limb Size Group I, pages 507, 518.)

F:A.M.31513, (?) *Phioceros* var., left metacarpus, from Beaver Creek, Kansas.

(See Limb Size Group I-, pages 497, 517.)

F:A.M.31671 and 31672, *Texoceros guymonensis*, n.sp., ref., left metacarpus and right metatarsus, from Guymon, Oklahoma.

(See Limb Size Group II, page 518.)

(Continued on next page)

(6) Dentitions from Nevada and Oregon

Paracosoryx and Meryceros species

As noted in preceding pages of the Horn Section, the following four species have been based on mandibular rami: two from the vicinity of Tonopah and one from High Rock Canyon, Nevada, and one from Skull Spring, Oregon.

Two species from the vicinity of Tonopah, Nevada, in the collections of the California Institute of Technology:

C. (Paracosoryx) loxocerus (Furlong).

TYPE.—Right ramus, C.I.T.1301.

Meryceros hookwayi (Furlong).

TYPE.—Right p_1 - m_2 , C.I.T.1257.

One species from High Rock Canyon, Nevada, in the collections of the University of California:

(?)*C. (Paracosoryx) nevadensis* (Merriam).

TYPE.—Left fragment with m_1 - m_2 , U.C.12608.

One species from Skull Spring Miocene, Oregon, in the collections of the California Institute of Technology:

(?)*C. (Paracosoryx)* species (Gazin).

EXAMPLE.—Right fragment of immature ramus, C.I.T. 383.

FIG. 48 (continued).

F:A.M.31592, *Ramoceros ramosus* (Cope), ref., left metacarpus and right metatarsus, from Lower Pojuaque Bluffs, New Mexico.

(See also Figs. 25B [partial manus], 28, 28A, 29, 30 [cranium and horns] and Limb Size Group II, page 453.)

F:A.M.31512A and 31514, *R. (Paramoceros) kansanus*, n.sp., ref., left metacarpus and metatarsus, and left metacarpus, from Kansas.

(See Limb Size Group II-, page 455.)

F:A.M.31719 and 31721, (?)*R.*, *C.* or *M.* species, right metacarpus and left metatarsus, from New Mexico.

(See Limb Size Group III, page 457.)

F:A.M.31942, *Plioceros dehlini*, n.sp., (?)ref., right metacarpus and metatarsus, from Keya Paha County, Nebraska.

(See Limb Size Group III, page 516.)

N.S.M.2-5-8-30, *Proantilocapra platycornea* Barbour and Schultz, left metacarpus and right metatarsus of genotype, from Cherry County, Nebraska.

(See also Fig. 50 [partial skull and ramus] and Limb Size Group III-, pages 510, 519.)

A.M.9475, (?)*Cosoryx furcatus*, var. or subsp., ref., right metacarpus and metatarsus, from Cedar Creek, Colorado.

(See also Fig. 25B [partial manus] and Limb Size Group IV+, page 461.)

F:A.M.31731, (?)*Submeryceros minimus*, var., left metacarpus, from New Mexico.

(See Limb Size Group V, page 467.)

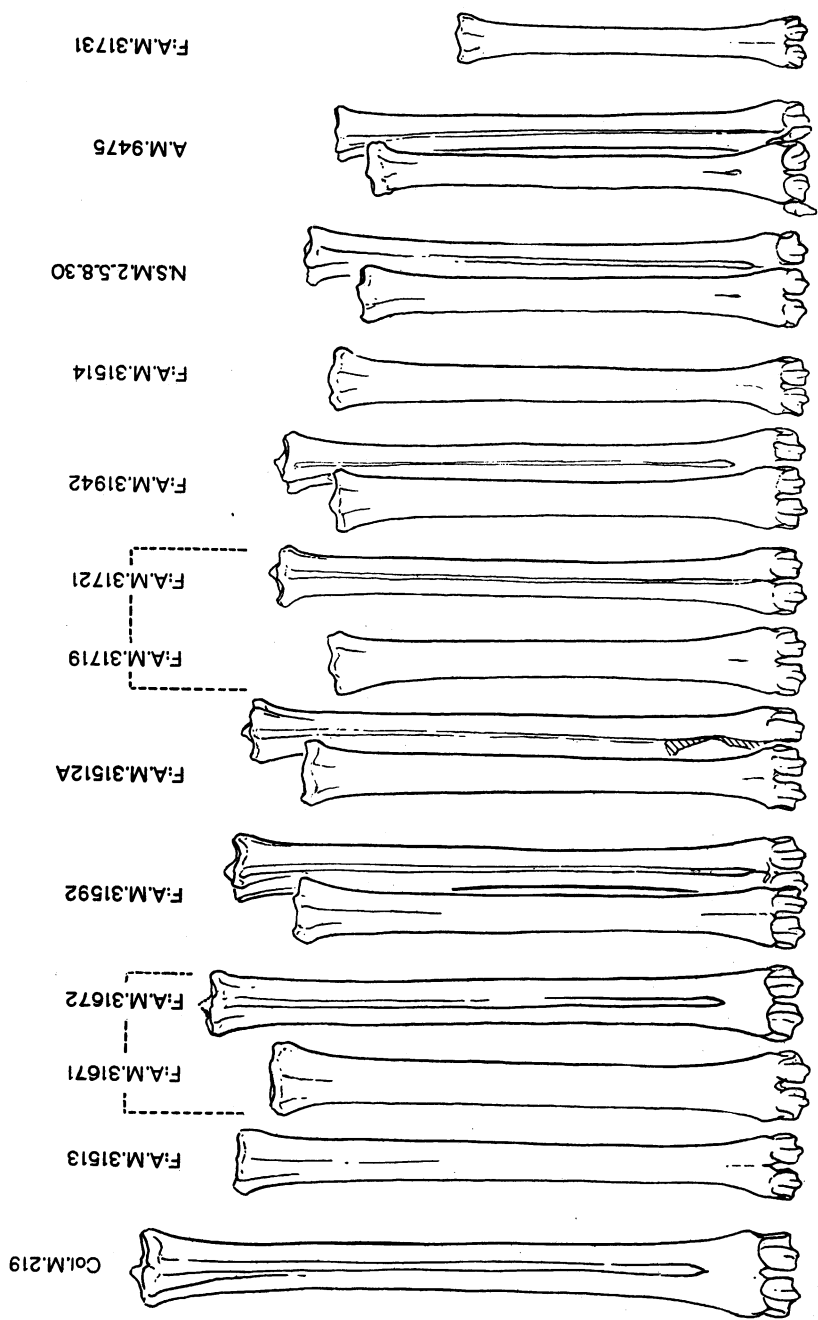


Fig. 48. Late Tertiary Antilocapriini and Merycodontini, relative size of metapodials.
 × 1. (See legend, pages 444, 445.)

SECTION IV.—MERYCODONTINI LIMB ELEMENTS

Figures 48A and (in part) 25B, 38, 48

Statement

The Merycodontine limbs are definitely of slender elongate Antilocaprine form. Metapodials allocated to the division vary in size from smaller specimens of the dimensions of the Lower Miocene *Aletomeryx* "marshi" to larger specimens which approximate in length the smaller individuals of the Pliocerotinæ. The metapodial lengths are equivalent to Size Groups II–V of the joint Merycodontini-Blastomerycini series. Unfortunately, little associated skeletal material is so far available. The nearest to a complete skeleton¹ associated with skull and dentition is that of the *Ramoceros osborni* type. Other cases of associated limbs are exemplified by the elements accompanying *Paramoceros kansanus*, F:A.M. 31512 and 31512A; *Paramoceros*, F:A.M. 31555, from Dutch Creek; and immature *Cosoryx*, F:A.M. 32450, from Gordon Creek, Nebraska.

The limb proportions of the *Ramoceros osborni* type skeleton, Size Group IV+, though somewhat slighter, tend to approximate *Aletomeryx marshi*. While in the Merycodontines the proximal ends of the splint bones apparently tend to be fused and retained, there is an unfortunate meagerness of evidence¹ as to the definite retention or loss of the distal splints and phalanges. (The splints and phalanges shown in the *R. osborni* type specimen are of plaster.) While lateral phalanges are retained in one of the Colorado metacarpi (A.M. 9475) formerly referred to *R. osborni* (now tentatively transferred to *Cosoryx*), there is no evidence of the distal splints themselves ever having been present. Though the dimensions of the *R. osborni* radius approximate those of the genotype of *Proantilocapra* Barbour and Schultz, the humerus, metacarpus and metatarsus, interestingly enough, are less elongate than in *Proantilocapra*. It is recalled that associated limbs from New Mexico, referred in a previous section of the report to (?) *Longirostromeryx blicki*, exhibit a lone lateral phalanx, and that the type of *Parablastomeryx gregorii* shows the fused proximal and detached distal remnants of the lateral metacarpals as well as complete lateral phalanges. Different-sized examples of Merycodontine metapodials are illustrated (Fig. 48) in conjunction with specimens of *Ramoceros ramosus*, of *Paramoceros kansanus* and of "Proantilocapra." (Also see Merycodontini and Blastomerycini comparative limb measurements and ratios of Table IX, following page.)

¹ The beautifully preserved skeleton of an immature individual of *Paracosoryx wilsoni* secured at the close of the 1936 field season from Long Quarry, Sioux County, Nebraska, by the Jack Wilson party, exhibits the retention of splints and lateral phalanges in the manus. (F:A.M. 33789, Figs. 25B and 48A.)

TABLE IX
MERYCOTINI AND BLASTOMERYCINI
COMPARATIVE LIMB MEASUREMENTS AND RATIOS

See additional ratios, p. 451.

	Locality	Collection No.	Limb Size Group	Humerus		Metacarpus	Femur		Tibia	Metatarsus	Humerus/Radius		Metacarpus/Radius		Radius/Tibia	
				mm.	mm.	mm.	mm.	mm.	mm.	mm.	%	%	%	%	%	%
* <i>Parablastomeryx gregori</i> , sub-genotype.....	Cherry Co., Nebr.	F.A.M.31360*	I	145	149	151	186	218	172	160-147	97	101			68	25,
† <i>Probarbouromeryx sweeti</i> , ref. ¹ ...	Morrill Co., "	Unassoc., p. 184				140										25B
<i>Ramoceros ramosus</i> , ref.....	St. Fé, N. M.	Unassoc., p.453-4	II		140-136	138-130		190	152-146							
"	"	F.A.M.31592*	"			132			150							48
<i>R. (Paramoceros) kansanus</i> , ref.....	Rawlins Co., Kans.	F.A.M.31512*	II-	112	134	134	150	178			83	100			76	
<i>C. (Paracosoryx) furlongi</i> , type (part).....	Ricardo, Calif.	U.C.26795	"						140							
(?) <i>C. (P.)</i> species, ref.....	Sioux Co., Nebr.	Unassoc., p. 463	"		130	128		165-152	139							
<i>Meryceros nenzelensis</i> , ref.....	Cherry Co., "	Unassoc., p.463-4	II, III		140-137	136-125	156-151		141-125							
<i>M. warreni johnsoni</i> , ref.....	"	Unassoc., p.464-5	II to IV	125-109	143-122	130-112	155-140	175-160	137-122							
"	"	N.S.M.19-19-9-34*		140				165	122							

See Figure

<i>M. warreni johnsoni</i> , var.....	Cherry Co., Nebr.	Unassoc., p. 466	III to V	131	125-105	132	167	130-116	97	75	
† <i>Plioceros dehluni</i> (♀), type (part) ¹	"	F.A.M. 32101*	III	129	125	140	172	140			
<i>C. (Paracosoryx) alticornis</i> , ref.....	Barstow, Calif.	F.A.M. 31841	"		(123)						
(?) <i>R.</i> , <i>C.</i> and, or, <i>M.</i> species.....	St. Fé, N. M.	Unassoc., p. 457	III, IV	128	128-119			137			48
* <i>Problastomeryx primus</i> , subgenotype (part).....	U. Rosebud, S. D.	A.M. 13822*	III	(137)		150	178	136		(77)	25A
* <i>P. olcottii</i> , ref.....	Lusk, Wyo.	Unassoc., p. 255	III-, IV				163	127			
* <i>Longirostromeryx serpentis</i> , ref....	Sioux Co., Nebr.	A.M. 22474E	III-					128			
*(?) <i>L. novomexicanus</i> , ref.....	S. Ildefonso, N. M.	F.A.M. 31723	"					128			
* <i>L. clarendonensis</i> , ref.....	Clarendon, Tex...	F.A.M. 32461	IV					117			
† <i>Proantilocapra platycornea</i> , genotype (part) ¹	Cherry Co., Nebr.	N.S.M. 2-5-8-30*	III-	107	116		168	132	90	70	48
<i>C. (Subcosoryx) cerroensis</i> , ref.....	Round Mt., N. M.	Unassoc., p. 456	III, IV	129-117	114	138	172-170	132-124			28
<i>Ramoceros osborni</i> , genotype (part).	Pawnee Cr., Colo.	A.M. 9476*	IV+	98	112	(140)	(170)	125	82	(70)	
(?) <i>C. (Paracosoryx) sabulonis</i> or	Sioux Co., Nebr.	Unassoc., p. 462-3		113	116	141	168-129	133-127			25A
(?) <i>C. (S.) sawaronis</i> , ref.....	"	Unassoc., p. 247	IV		110			120			
* <i>Blasomeryx elegans</i> , ref.....	"	Unassoc., p. 248	"		110			123			25A
* <i>B. gemmifer medius</i> , ref.....	Cuyam'gue, N. M.	F.A.M. 31729	"	113	110			120			25A
(?) <i>Longirostromeryx blicki</i> , ref....			"	112							
* <i>Blasomeryx mefferdi</i> , ref.....	Brown Co., Nebr.	F.A.M. 31953	"					120			

(Continued on next page)

TABLE IX—Continued

See additional ratios, p. 451.

	Locality	Collection No.	Limb Size Group	Humerus		Radius		Metacarpus		Femur		Tibia		Metatarsus		Humerus/Radius		Metacarpus/Radius		Radius/Tibia		See Figure
				mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	%	%	%	%	%	%	
<i>R. (Merriamoceros) coronatus</i> , ref....	Barstow, Calif.	F:A.M.31020A	IV			111																
<i>C. (Paracosoryx) wilsoni</i> , ref.....	Sioux Co., Nebr.	Unassoc., p. 462	IV, V	104	123-114	110-97	159-140	125-107														
<i>Cosoryx furcatus</i> , ref.....	Cherry Co., "	F:A.M.32369 ²	"		120	109	133	120										91		77		
"	"	Unassoc., p. 458	"		117-108	111-104	139-123	151-144	121-109													
"	"	Unassoc., p. 459	"		115-105	107-100	130	160-143	120-107													
(?) <i>Submyceros minimus</i> , var.....	St. Fé, N. M.	F:A.M.31731	V			91																48
* <i>Pseudoblastomeryx falkenbachii</i> , subgenotype (part).....	Lusk, Wyo.	F:A.M.31530 ²	"	(94)	(98)	90	128	142	109	(96)	(92)	(69)	95A									
* <i>P. advena</i> , ref.....	Rosebud, S. D.	A.M.13015	VI			80			97				95A									
* <i>P. schultzi</i> , ref.....	Morrill Co., Nebr.	Unassoc., p. 259	"			80			98													
* <i>Machæromeryx tragulus</i> , geno- type (part).....	Harrison, "	A.M.20548 ²	VII+	83	92	73	(105)		90	90	79											
* (?) <i>Blastomeryx</i> species.....	Cherry Co., "	F:A.M.32195	VII						79													
" ref.....	Sioux Co., "	A.M.14131	VIII						71													95A

* Blastomeryxini; † Dromomeryxini; ‡ Antilocaprinii; () approximate measurement.

¹ For comparison.

For additional ratios, see next page.

(Continued at top of next page)

TABLE IX—Continued
ADDITIONAL RATIOS

	Humerus	Metacarpus	Femur	Tibia	Metatarsus	Tibia	Metacarpus	Metatarsus	Humerus	Femur
	%		%		%		%		%	
F:A.M.31360.....	96		85		79		88		78	
F:A.M.31592.....							89			
F:A.M.31512.....	84		84						75	
N.S.M.19-19-9-34.....			85		74					
F:A.M.32101.....			81		81		89			
A.M.13822.....			84		76					
N.S.M.2-5-8-30.....	92				79		88			
A.M.9476.....	88		(82)		(74)		90		(70)	
F:A.M.32369.....			86		77		91			
F:A.M.31530.....	(104)		90		77		82		(73)	
A.M.20548.....	114						81		79	

The referred limb elements from the several areas are representative of the following Limb Size Groups:

	LIMB SIZE GROUPS				
(1) New Mexico.....	II	III	IV	V	
(2) Colorado.....			IV+		
(3) South Dakota, Kansas and Montana.....	II-	III			
(4) Nebraska:					
Brown, Keya Paha and Cherry Counties	II	III	IV	V	
Sioux County.....	II-		IV,IV+	V	
(5) California:					
Barstow.....		III	IV		
Ricardo.....	II-				

Species Relisted

Twenty-two or more species and subspecies seem to be represented by limb elements; where the association is definite, the species are starred. (Numbers in parentheses refer to species in Horn Section II—compare species summary, page 317. See Figs. 48A and [in part] 25B, 38, 48, and Measurement Table IX.)

* = elements associated with horns or dentitions

Ramoceros, NEW GENUS

*(1) *R. ramosus* (Cope), referred, from New Mexico. This paper, Figs. 25B, 48 (F:A.M.31592).

[Limb Size Group II.]

*(3) *R. osborni* (Matthew), from Pawnee Creek, Colorado.

[Limb Size Group IV+.]

Species (2) and (4) are not represented by limbs.

Paramoceros, NEW SUBGENUS

- * (6) *R. (P.) howardæ*, referred, from Dutch Creek, Brown County, Nebraska.
[Limb Size Group III.]
- * (7) *R. (P.) kansanus*, n.sp., referred, from Kansas. This paper, *Fig. 48* (F:A.M. 31512A and 31514).
[Limb Size Group II-.]
- Species (5), (8) and (9) are not represented by limbs.

Merriamoceros, NEW SUBGENUS

- (10) *R. (M.) coronatus* (Merriam), referred, from Barstow, California.
[Limb Size Group IV.]

Cosoryx LEIDY (AND *Subcosoryx*, NEW SUBGENUS)

- (1) *C. (S.) cerroensis*, n.subg. and sp., from New Mexico. This paper, *Fig. 38* (F:A.M. 32971 and 32974).
[Limb Size Groups III and IV.]
- * (2) (?) *C. ilfonsensis*, n.sp., referred, from San Ildefonso, New Mexico.
[Limb Size Group III.]
- * (2x) (?) *R.*, *C.* and, or, *M.* species, from New Mexico. This paper, *Fig. 48* (F:A.M. 31719 and 31721).
[Limb Size Groups III and IV.]
- * (3, in part) *C. furcatus* Leidy, referred, from Cherry and Brown Counties, Nebraska. This paper, *Fig. 25B* (N.S.M. 59-4-7-34).
[Limb Size Groups IV and V.]
- * (3, in part) *C. furcatus*, large var., from Garman Loup Fork Collection, Nebraska.
[Limb Size Group II.]
- (5) (?) *C. furcatus*, var. or subsp., referred, from Little White River, South Dakota.
[Limb Size Group III.]
- (6a) (?) *C. agilis* Douglass, from Madison Valley Beds, Montana.
[Limb Size Group uncertain, immature.]
- (7) (?) *C. furcatus*, var. or subsp., referred, from Colorado. This paper, *Figs. 25B, 48* (A.M. 9475).
[Limb Size Group IV+.]

Species (4), (6) and (6b) are not represented by limbs.

Paracosoryx, NEW SUBGENUS [AND (?) *Subparacosoryx*, NEW SUBGENUS]

- (8) *C. (P.) alticornis*, n.sp., referred, from Barstow, California.
[Limb Size Group III.]
- * (9) *C. (P.) furlongi*, n.sp., from Ricardo, California.
[Limb Size Group II-.]
- (13) *C. (P.) wilsoni*, n.subg. and sp., referred, from Antelope Draw, Sioux County, Nebraska. This paper, *Figs. 25B* (F:A.M. 32479A, 33789), *48A* (F:A.M. 33789).
[Limb Size Groups IV and V.]
- (14a) (?) *C. (P.) sabulonis* (Matthew and Cook), and possibly (14) (?) *C. (S.) savaronis*, n.subg. and sp., referred, from Sioux County, Nebraska.
[Limb Size Group IV+.]
- (14b) (?) *C. (P.)* species, from Sioux County, Nebraska.
[Limb Size Group II-.]
- Species (8a), (10), (11), (11a), (11b), (12), (15) and (16) are not represented by limbs.

Meryceros, NEW GENUS

- (3) *M. nenzelensis*, n.sp., referred, from Nenzel Quarry, Cherry County, Nebraska.
[Limb Size Groups II and III.]
- (4a) *M. warreni johnsoni*, n.subsp., referred, from Crookston Bridge Quarry, and (4a') var. from Valentine Quarry A, Cherry County, Nebraska. This paper, *Fig. 25B* (N.S.M. 23-6-8-30).
[Limb Size Groups II to V.]

- (6) (?) *M. joraki*, n.sp., referred, from Barstow, California.

[Limb Size Groups III and IV.]

Species (1), (2), (4), (4b), (5) and (7) are not represented by limbs.

Submeryceros, NEW SUBGENUS

- (10) (?) *S. minimus*, var., from New Mexico. This paper, *Fig. 48* (F:A.M.31731).

[Limb Size Group V.]

Species (8), (9), (9a) and (9b) are not represented by limbs.

Detailed Lists of Limb Elements of the Above Genera and Species

Ramoceros, NEW GENUS

LIMB SIZE GROUP II.

- (1) *R. ramosus* (Cope), referred

From New Mexico

Limb elements are exemplified by four referred partial skeletons (two of which are associated with dentition) and etc. detached bones:

Partial right and left humerus, partial radius, left manus: metacarpus, two 1st, two 2d, two 3d phalanges; partial right and distal four-fifths left tibia, right pes: tarsus, metatarsus, two 1st phalanges; left pes: tarsus, metatarsus (broken), two 1st phalanges.

F:A.M.31592

From Lower Pojuaque Bluffs. This paper, *Figs. 25B* (partial manus), *48* (left metacarpus and right metatarsus).

(See associated posterior one-half of skull, left maxilla and left ramus, Horn Section II, page 324; Dentition Section III, page 399. This paper, *Figs. 28, 28A, 29, 30* [cranium and horns].)

Distal four-fifths right and one-half left humerus, fragments of right and left radii, left and distal four-fifths right metacarpus, three 1st phalanges, distal one-half left femur, left, 190 mm., and distal three-fourths right tibia, right tarsus, proximal portions left and right metatarsi.

F:A.M.30941

From Pojuaque Bluffs, 1929.

(See associated partial left maxilla and partial mandible, Dentition Section III, page 399.)

Distal two-thirds left humerus, distal one-half metacarpus, two partial tibiae, calcaneum, distal three-fourths and two-thirds metatarsus.

F:A.M.31698

From N. Pojuaque Bluffs, 1928.

Immature:

Distal one-fourth left humerus, proximal one-fifth radius and ulna, right and left metacarpi, nearly complete femur, distal one-fourth right tibia, left and proximal two-thirds right metatarsus, right calcaneum and astragalus, and partial left calcaneum.

F:A.M.31697

From N. Pojuaque Bluffs,
1928.

Etc. detached limb elements:

Distal four-fifths right humerus.

F:A.M.31699

From Espanola area, 1926.

Distal one-half right humerus.

F:A.M.31699A

From Espanola area, 1926.

Right radius, 136 mm.

F:A.M.31702

From Santa Fé area, 1924.

Left radius, 140 mm.

F:A.M.31701

From Santa Cruz, 1927.

Nearly complete right radius.

F:A.M.31703

From an indefinite area.

Right metacarpus, 138 mm.

F:A.M.31704

From Santa Clara, 1931.

Left metacarpus, 130 mm.

F:A.M.31705

From Santa Fé area, 1924.

Distal one-third right tibia.

F:A.M.31707A

From Santa Fé area.

Left metatarsus, 146 mm.

F:A.M.31707

From Santa Fé area, 1927.

Right metatarsus, 152 mm.

F:A.M.31708

Santa Cruz, 1st wash, 1928.

LIMB SIZE GROUP IV+.

(3) *R. osborni* (Matthew)

From Pawnee Creek, Colorado

GENOTYPE (in part).—Skeletal elements, including: right and distal three-fourths left humerus, both ulno-radii, carpi and metacarpi; two 1st, two 2d and one 3d phalanges of right manus; two 1st, two 2d and one 3d phalanges of left manus; partial pelvis, distal one-fifth right and two-thirds left tibia, both tarsi and metatarsi; two 1st, two 2d and two 3d phalanges of right pes; two 1st, two 2d and two 3d phalanges of left pes; several vertebrae.

A.M.9476

From Cedar Creek, 1901.

Figured by Matthew, 1904,
Pl. III and Text-Figs. 9-13,
15.

(No evidence of lateral phalanges—supplied in mount in plaster.)

(See associated partial skull and ramus, Horn Section II, page 328; Den-tition Section III, page 406. This paper, *Figs. 28, 28A* [skull], *43* [ramus].)

Paramoceros, NEW SUBGENUS

LIMB SIZE GROUP III.

(6) *R. (P.) howardæ*, referred

From Dutch Creek, Brown County, Nebraska

Left humerus, nearly complete right and three-fourths left radius, distal one-third metacarpus, proximal one-half right femur, nearly complete right tibia, right calcaneum and astragalus, proximal two-thirds right metatarsus, etc. detached phalanges.

F:A.M.31555

 $\frac{1}{4}$ mile from head of Dutch Creek, 1929.

(See associated partial ramus, Dentition Section III, page 413.)

LIMB SIZE GROUP II—.

(7) *R. (P.) kansanus*, n.sp., referred

From Kansas

Astragalus and 1st phalanx.

F:A.M.31510

From M. F. Frake's ranch, 16 miles S.E. of Trenton, Nebraska, 1933.

(See questionably associated type horn, Section II, page 331.)

Left humerus; right humerus, radius and ulna articulated; right carpus and metacarpus, left femur, right and broken left tibia.

F:A.M.31512

From north fork of Sappa Creek, N.W. of Achilles, Rawlins County, 1933.

(See associated partial mandible, Dentition Section III, page 410.)

Left radius, ulna and metacarpus articulated; distal one-half right radius, right metacarpus, distal one-third left femur, right tibia and left metatarsus.

F:A.M.31512A

From north fork of Sappa Creek, N.W. of Achilles, 1933.

This paper, *Fig. 48* (left metacarpus and metatarsus).

Slenderer:

Right metacarpus, 135 mm.

A.M.2667

From Phillips County, 1894.

Left metacarpus.

F:A.M.31514

Silica mine at Calvert, 1933. This paper, *Fig. 48*.*Merriamoceros*, NEW SUBGENUS

LIMB SIZE GROUP IV.

(10) *R. (M.) coronatus* (Merriam), referred

From Steepside Quarry, Barstow, California

Right metacarpus, 111 mm.

F:A.M.31020A

Cosoryx LEIDY (AND *Subcosoryx*, NEW SUBGENUS)

LIMB SIZE GROUPS III TO V.

(1) *C. (S.) cerroensis*, n.subg. and sp., referred

From Round Mountain Quarry, New Mexico

As seen in radii, the maximum variation in length is 10%

S.G. III.	F:A.M.
Right radius, 129 mm.....	32968
Left femur, 138 mm.....	32969
Two right tibiae, 172-170 mm.....	32970, A
Two right metatarsi, 132-129 mm.....	32971 (<i>Fig. 38</i>), B
Two left and two right metatarsi.....	32971A, D, C, E

S.G. IV.

Articulated: distal half right humerus, radius (124 mm.) with portion of ulna and right metacarpus (116 mm.)....	32972
Distal third left humerus.....	32972A
Right radius, 119 mm.	32976
Right metacarpus.....	32973
Right metacarpus, 116 mm.....	32973A
Two left metacarpi.....	32973B, D
Left metacarpus, 114 mm.....	32973C
Distal half left tibia.....	32970B
Right metatarsus, 124 mm.....	32974 (<i>Fig. 38</i>)
Left metatarsus, tarsus and phalanges.....	32975

S.G. V. (IMMATURE.)

Left radius, 117 mm.....	32976A
Immature right metatarsus and two 1st phalanges.....	32977
Immature left metatarsus.....	32977A
Several tarsals, carpals and footbones, F:A.M. Coll.	

(See horns, Section II, page 336; and ramal and maxillary dentitions, Section III, page 392.)

LIMB SIZE GROUP III.

(2) (?) *C. ilfonsensis*, n.sp., referred

From New Mexico

Distal one-half left humerus, nearly complete left ulno-radius, left carpus, proximal two-thirds left metacarpus, distal one-third left tibia, left tarsus, broken left metatarsus, two 1st phalanges, etc. fragments.	F:A.M. 31730	From San Ildefonso, 1929.
--	--------------	---------------------------

(See associated skull [female], Dentition Section III, page 401.)

Immature specimen:

Partial left scapula, right femur (minus head and condyles), right tibia, left pes: tarsus (except calcaneum), metatarsus, one 1st, one 2d phalanx; right pes: calcaneum, metatarsus, three 1st, three 2d, two 3d detached phalanges; and two vertebrae.

F:A.M.31724

From San Ildefonso, 1929.

LIMB SIZE GROUPS III AND IV.

(2x) (?) *R.*, *C.* and, or, *M.* species

From New Mexico

S.G. III.

Distal two-thirds right humerus, nearly complete right ulno-radius, right carpus and metacarpus, distal two-thirds left femur, proximal one-third left tibia.

F:A.M.31711

From horizon above Skull Ridge, 1931.

(See associated right ramus, Dentition Section III, page 399.)

Distal one-half left humerus.

F:A.M.31716A

From Santa Fé area.

Left radius, 128 mm.

F:A.M.31715

From Tesuque, 1930.

Distal one-third left radius.

F:A.M.31716B

From Santa Fé area.

Left metacarpus.

F:A.M.31717

From Espanola area, 1928.

Left metacarpus.

F:A.M.31718

From Santa Clara, 1931.

Right metacarpus, 124 mm.

F:A.M.31719

From Santa Fé area, 1924.
This paper, *Fig. 48*.

Left metacarpus, 128 mm.

F:A.M.31716

From an indefinite locality.

Right metacarpus, distal end missing.

F:A.M.31720

From North Pojuaque Bluffs,
1927.

Left metatarsus, 137 mm.

F:A.M.31721

From west side of North
Pojuaque Bluffs, 1928.
This paper, *Fig. 48*.

Right metatarsus.

F:A.M.31722

From Santa Fé area.

S.G. IV.

Distal four-fifths left humerus.

F:A.M.31712

From Santa Clara Canyon,
1931.

Right metacarpus, 119 mm.

F:A.M.31725

North Pojuaque Bluffs, 1927.

Right metacarpus.

F:A.M.31726

From Skull Ridge, 1927.

Left metacarpus.

F:A.M.31727

North Pojuaque Bluffs, 1928.

Right tibia, proximal end missing.

F:A.M.31728

From Santa Fé area, 1928.

LIMB SIZE GROUPS IV AND V.

(3, in part) *C. furcatus* Leidy, referred

From Cherry and Brown Counties, Nebraska

(a) From Midway Quarry, Cherry County, 1934:

Several less complete and immature limb bones are not listed below. Two metacarpi, F:A.M.32387 and 32389, are unusually slender-proportioned. The longest metatarsus, F:A.M.32394, is 11% longer than the shortest, F:A.M.32396C.

Left radius, 117 mm.	F:A.M.32385
Left radius, 108 mm.	F:A.M.32386
Two right metacarpi.	F:A.M.32388 and A
Right metacarpus, 111 mm.	F:A.M.32387
Left metacarpus, 104 mm.	F:A.M.32389
Right femur, 139 mm.	F:A.M.32390
Eleven femora.	F:A.M.32390A-K
Right femur, 123 mm.	F:A.M.32390L
Three broken femora.	F:A.M.32390M, N and P
Two broken left tibiae.	F:A.M.32391 and A
Left tibia, 151 mm.	F:A.M.32391B
Left tibia.	F:A.M.32392
Two left tibiae.	F:A.M.32393 and A
(Slightly immature.)	
Right metatarsus, 121 mm.	F:A.M.32394
Eight metatarsi.	F:A.M.32394A-D, 32395, 32396, A and C
Left metatarsus, 109 mm.	F:A.M.32396B
Also several calcanea, astragali and phalanges.	F:A.M. Coll.
45 immature limb bones.	F:A.M. Coll.

(See partial crania and horn-cores, Section II, page 340; and ramal and maxillary dentitions, Section III, page 414.)

(b) From Gordon Creek Quarry, Cherry County:

Right humerus, radius and femur, left tibia and metatarsus, one complete and one partial right calcaneum, two right astragali, left tarsals and two phalanges. (There is no certainty of the association of the limbs.)	N.S.M. 1-9-8-28
---	--------------------

Articulated immature specimen, 1934:

Distal four-fifths left and one-half right humerus, both radii and ulnae, right carpus and metacarpus, both femora, right patella, proximal two-thirds right and one-half and distal end of left tibia, left metatarsus, two 1st, two 2d and two 3d phalanges, twelve vertebrae, sacrum, parts of both ilia, etc. ribs. (See associated skull and mandible, Horn Section II, page 341; Dentition Section III, page 417. This paper, <i>Fig. 26</i> .)	F:A.M. 32450
---	-----------------

Detached mature specimens, 1934. As seen in radii, the maximum variation length is 9%:

Five partial humeri.	F:A.M.32444 and A-D
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Left radius, 115 mm.	F:A.M.32445
Two left radii.	F:A.M.32445A, B
Left radius, 105 mm.	F:A.M.32445C
Rightmetacarpus, 107mm.	F:A.M.32446
Right metacarpus.	F:A.M.32446A
Left metacarpus, 100 mm.	F:A.M.32446B
Right femur, 130 mm.	F:A.M.32447
Right tibia, 160 mm.	F:A.M.32448
Four tibiæ.	F:A.M.32448A, B, D, E
Left tibia, 143 mm.	F:A.M.32448C
Left metatarsus, 120 mm.	F:A.M.32449
Four metatarsi.	F:A.M.32449A-D
Rightmetatarsus, 107 mm.	F:A.M.32449E
Left metatarsus.	N.S.M.13-31-7-29
Also several immature and incomplete limbs.	F:A.M. Coll.

(See partial crania and horn-cores, Section II, page 341; and ramal and maxillary dentitions, Section III, page 416.)

(c) From Swallow Quarry, Snake River, Cherry County, 1934:

An articulated fore-leg, N.S.M.59-4-7-34, and other immature fore and hind-leg bones are included in the collection from Swallow Quarry and listed below. A metatarsus, N.S.M.75-4-7-34, is 8% larger than the shortest, N.S.M.9-4-7-34.

Articulated mature specimens:

Distal three-fourths right humerus, right ulno-radius, 125 mm., carpus and metacarpus, all phalanges.....	N.S.M. 59-4-7-34 Fig. 25B
Left tibia (head missing), tarsus, metatarsus and all phalanges.....	1-4-7-34

Articulated immature specimens:

Right tibia (distal epiphysis missing), two tarsals, metatarsus and all phalanges.....	3-4-7-34
Right femur and tibia (proximal epiphyses missing).....	4-4-7-34
Distal two-thirds left humerus, left radius (distal epiphysis missing).	2-4-7-34

Detached mature specimens:

Left metacarpus.....	11-4-7-34
Right tibia, 163 mm.....	78-4-7-34
Left tibia, 150 mm.....	6-4-7-34
Right tibia.....	77-4-7-34
Right metatarsus, 126 mm.....	75-4-7-34
Left metatarsus.....	52-4-7-34
Right metatarsus, 117 mm.....	9-4-7-34
Left metatarsus.....	4-4-7-34

(See partial skulls, Section II, page 342; and ramal and maxillary dentitions, Section III, page 417.)

(d) From Burge Quarry, Snake River, Cherry County, 1935:

- Partial skeleton, including right radius and ulna, nearly complete left radius, three carpals, left metacarpus, right femur and tibia, left metatarsus and two tarsals..... F:A.M. 32369
 Etc. detached limbs, F:A.M. Coll.

LIMB SIZE GROUP IV (*C. furcatus* Leidy, referred).

(e) From McConnell's Ranch, Brown County, 1932:

- Right metacarpus..... 31948

(f) From Quinn Quarry, Brown County, 1927:

- Proximal one-half left and right metacarpi..... 31948A,B
 Left tibia..... 31951
 Three partial metatarsi.

(g) From upper layer, Dutch Creek, Brown County, 1929:

- Distal one-third right and left tibia, proximal portions right and left metatarsus, left tarsus and parts of pelvis..... 32083

LIMB SIZE GROUP II.

(3, in part) *C. furcatus*, large var.

From Garman Loup Fork Collection, Nebraska

- Distal portion left scapula, distal one-half right and three-fourths left humerus, proximal portion left ulna, four left carpals, proximal one-half and distal one-fourth left and distal two-thirds right metacarpus, distal one-third left tibia, right and left tarsi, proximal one-half left and one-third right metatarsus, four 1st and two 2d phalanges..... M.C.Z. 17743
 One-half pelvis, portion of scapula, series of vertebrae, metapodial. Skeleton figured by Scott, 1890, Pl. I, under *Cosoryx furcatus* referred. (See associated left horn-core, Horn Section II, page 344; and partial mandible, etc., Dentition Section III, pages 418, 429. This paper, *Fig. 45*, ramus.)..... M.C.Z. 10101 [F:A.M. cast]

Somewhat smaller:

- Distal one-third left humerus, right and proximal four-fifths left radius and partial calcaneum..... M.C.Z. 10095
 Proximal portion right ulna, right and left radii, right metacarpus, distal one-fourth left tibia, right metatarsus, one 1st phalanx..... 17743
 Distal one-half left humerus, proximal portion right ulna, proximal three-fourths right metacarpus, distal end right tibia, partial right calcaneum, right astragalus, right and proximal one-half and distal one-third left metatarsus..... 17743

[In addition to the above, the Burge Quarry has produced in 1935 two specimens of the larger Size Group II, whose reference remains in doubt:

- Left radius, 140 mm..... F:A.M. 32912
 Left metacarpus, 127 mm..... 32913]

LIMB SIZE GROUP III.

(5) (?) *C. furcatus*, var. or subsp., referred

From Little White River, South Dakota

Distal one-fourth humerus, right metatarsus (distal end missing), distal one-fourth metatarsus.....	A.N.S.P. 11405
Two astragali.....	11360A 11361A

LIMB SIZE GROUP UNCERTAIN.

(6a) (?) *C. agilis* Douglass

From Madison Valley Beds, Montana

Partial manus, pes, radius, ulna, etc.	C.M.703
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(Probably limbs of different individuals found with type immature partial skull and mandible. See Horn Section II, page 346; Dentition Section III, page 411.)

LIMB SIZE GROUP IV+.

(7) (?) *C. furcatus*, var. or subsp., referred

From Colorado

Three examples from Cedar Creek, 1901:

Right manus: two carpals, metacarpus, two 1st, one 2d phalanges, rudimentary 1st, 2d and 3d internal lateral phalanges; right pes: two tarsals, metatarsus, and two 1st phalanges.	A.M.9475	Figured by Matthew, 1904, Text-Figs. 14, 16 (partial manus and pes); this paper, Figs. 25B (partial manus), 48 (right metacarpus and metatarsus).
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(See questionably associated forked horns, left maxilla and ramus, Horn Section II, page 346; Dentition Section III, page 406.)

Distal one-fourth right and left tibia, both tarsi and metatarsi (left without distal epiphyses), two right 1st phalanges.....	A.M. 9473
Distal half both humeri, distal half right radius, right metatarsus, calcaneum, etc. fragments.....	9474

Fragment from Pawnee Creek:	F:A.M.
Distal one-fourth left tibia.....	31646

Paracosoryx, NEW SUBGENUS [AND (?) *Subparacosoryx*, NEW SUBGENUS]

LIMB SIZE GROUP III.

(8) *C. (P.) alticornis*, n.sp., referred

From Barstow, California

Left metacarpus.	F:A.M.31841	Valley View Quarry, 1933.
Broken left tibia.	F:A.M.31844	From Skyline Quarry, 1933.
Proximal one-half left metatarsus.	F:A.M.31834D	From Skyline Quarry, 1933.

LIMB SIZE GROUP II-.

(9) *C. (P.) furlongi*, n.sp.

From Ricardo, California

Metatarsus.	U.C.26795	Figured by Furlong, 1927,
Length	= 140 mm.	Text-Fig. 16.
Diameter middle shaft	= 11	

(See associated type partial cranium, maxillary series and ramus, Horn Section II, page 349; Dentition Section III, page 444.)

LIMB SIZE GROUPS IV AND V.

(13) *C. (P.) wilsoni*, n.subg. and sp., referred

From Long Quarry, Antelope Draw, Sioux County, Nebraska, 1934-35

The larger limbs are somewhat smaller than the limbs referred to (?) *C. (Parasoryx) sabulonis* (Matthew and Cook).

	F:A.M.
Left humerus, 104 mm.....	31937
Five left and two right partial humeri.....	31937A-C, 31944A-C
Right radius, 123 mm.....	31938
Four right and four left radii.....	31938A, 32478B-G
Right radius, 114 mm.....	32478A
Right radius, 106 mm.....	32478H
Right metacarpus, 110 mm.....	32479H
Nine right and four left metacarpi.....	32479B-G, J-N, P
Right metacarpus, 97 mm.....	Fig. 25B 32479A
Right femur, 133 mm.....	31939A
Right femur.....	31939
Right femur, (123) mm.....	31939B
Right tibia, 159 mm.....	31940
Eleven right and six left tibiae.....	31940A, 31945A, B, 32480A-E, G, H, J-N
Right tibia, 140 mm.....	32480I
Left metatarsus, 125 mm.....	31941
Five right and nine left metatarsi.....	31946A-D, 32481A-I
Left metatarsus, 107 mm.....	32481

Immature skeleton, F:A.M.33789, Fig. 25B, 48A. (See pages 316, 351 and 447 [footnote].) (Collected 1936; not included in count.)

(See referred crania, Section II, page 351; and referred ramal and maxillary dentitions, Section III, page 429.)

LIMB SIZE GROUP IV+.

(14a) (?) *C. (P.) sabulonis* (Matthew and Cook), referred,
and possibly (14) (?) *C. (S.) savaronis*, n.subg. and sp., referred

From Sioux County, Nebraska

Twenty-one detached limb elements from Snake Creek area:

Left humerus, 113 mm.	A.M.22473D	Quarry B, 1921.
Right humerus.	A.M.22474A	Quarry A, 1921.
Distal four-fifths right humerus.	A.M.22474B	Quarry A, 1921.

Distal four-fifths left humerus.	A.M.22473F	Quarry B, 1921.
Right radius.	A.M.14125C	1908.
Proximal three-fourths left radius.	A.M.14125B	1908.
Proximal four-fifths left radius.	A.M.14125D	1908.
Two right metacarpi.	A.M.14132A, H	1908.
Left metacarpus, 116 mm.	A.M.22473G	Quarry B, 1921.
Left metacarpus.	A.M.14132G	1908.
Right femur.	A.M.22474C	Quarry A, 1921.
Right femur, 141 mm.	A.M.22473H	Quarry B, 1921.
Right tibia, 129 mm.	A.M.14125A	1908.
Right tibia (br.), 168 mm.	A.M.22473C	Quarry B, 1921.
Two left tibiae.	A.M.22473A, B	Quarry B, 1921.
Right metatarsus, 133 mm.	A.M.22474F	Quarry A, 1921.
Right metatarsus, 127 mm.	A.M.22473E	Quarry B, 1921.
Left metatarsus.	A.M.22474G	Quarry A, 1921.
Left metatarsus.	A.M.14132F	1908.

(See referred horns, Section II, page 353; and ramal and maxillary dentitions, Section III, page 430.)

LIMB SIZE GROUP II-.

(14b) (?)*C. (P.)* species

From Sioux County, Nebraska

(Not cited in Table VII)

Right radius, 130 mm.	F:A.M.31897	From E. Sinclair Draw, 1933.
Right metacarpus, 128 mm.	A.M.22477C	From Stonehouse Draw, 1923.
Right tibia, 165 mm.	A.M.22475	From Quarry C, 1921.
Right tibia, 152 mm.	A.M.14125	From Snake Creek area, 1908.
Two right metatarsi. A = 139 mm.	A.M.22477X, A	From Stonehouse Draw, 1923.

Meryceros, NEW GENUS

LIMB SIZE GROUPS II AND III.

(3) *M. nenzelensis*, n.sp., referred

From Nenzel Quarry, Cherry County, Nebraska, 1934

(See Horn Section II, page 359, and Dentition Section III, page 421.)

A difference of 12% between the longest and shortest metatarsi

	F:A.M.
Left humerus.....	32220
Distal four-fifths left humerus.....	32221
Left radius, 140 mm.....	32222
Right radius.....	32223
Right radius, 137 mm.....	32224

	F.A.M.
Three left metacarpi.....	32225-7
Right metacarpus, 136 mm.....	32241
Right metacarpus, 125 mm.....	32241A
Right metacarpus.....	32228
Left metacarpus (distal epiphyses missing).....	32241B
Right femur, 156 mm.....	32229
Right femur, 151 mm.....	32230
Left tibia (head missing).....	32231
Distal four-fifths of three tibiae.....	32232-3, 32242
Two right tibiae (incomplete, immature).....	32242A, B
Right metatarsus, 141 mm.....	32234
Five metatarsi.....	32235-8, 32240
Right metatarsus, 125 mm.....	32239

LIMB SIZE GROUPS II TO IV.

(4a) *M. warreni johnsoni*, n.subsp., referred

From Crookston Bridge Quarry, Cherry County, Nebraska

(See Horn Section II, page 362, and Dentition Section III, page 423.)

The material includes an articulated hind-limb, N.S.M.1-3-8-34. Larger, intermediate and smaller-sized limbs are represented. The longest radius, N.S.M.42-17-9-34, is 17% longer than the shortest, N.S.M.31-15-8-34.

Articulated:

Left femur, 149 mm., N.S.M.1-3-8-34
tibia, 171, calcaneum and
astragalus, metatarsus
(124), and two 1st phalanges.

(In the same block as above, but apparently limbs of two or more individuals):

Left scapula, right and N.S.M.1-3-8-34
left radii, 135 mm., proximal one-half right ulna,
left metacarpus (120),
right metacarpus with all
phalanges, left femur, 148,
left metatarsus, 127, right
metatarsus.

Larger than above:

Left metatarsus, 133 mm. N.S.M.1-3-8-34
Both femora, 140 mm., N.S.M.19-19-9-34
patellæ, tibiae, 165, tarsi,
metatarsi, 122, pelvis, sacrum and lumbar vertebrae.
(Bones articulated.)

Detached elements:

Left humerus, 125 mm. N.S.M.29-3-8-34
Left humerus, 109 mm. N.S.M.91-15-8-35
Two humeri. N.S.M.49-17-9-34, 37-15-8-34

Two partial humeri.	N.S.M.35, 23-15-8-34
Right humerus (immature).	N.S.M.36-15-8-34
Right radius and ulna.	N.S.M.30-15-8-34
Right radius, 143 mm.	N.S.M.42-17-9-34
Twelve radii.	N.S.M.23, 39, 41, 43, 44, 46-48, -17-9-34 12-19-9-34 32, 33-15-8-34 27-3-8-34
Right radius, 122 mm.	N.S.M.31-15-8-34
Fifteen metacarpi.	N.S.M.22, 30-34, 36-17-9-34 39, 41, 42, 44-15-8-34 19, 20, 22-3-8-34 7-19-9-34

Left metacarpus, distal epiphyses missing. N.S.M.5-9-8-34

(See ?associated immature skull, Horn Section II, page 365.)

Left metacarpus, 130 mm.	N.S.M.13-27-7-34
Left metacarpus, 114 mm.	N.S.M.11-27-7-34
Right metacarpus, 112 mm.	N.S.M.65-15-8-35
Seven femora.	N.S.M.55, 57-60, -17-9-34 18-15-8-34 25-3-8-34

Left femur. N.S.M.4-7-9-34

(See ?associated skull, Horn Section II, page 365. This paper, *Fig. 28B.*)

Right femur, 155 mm.	N.S.M.2-28-8-35
Left femur, 150 mm.	N.S.M.17-15-8-34
Right femur, 140 mm.	N.S.M.56-17-9-34
Six tibiae.	N.S.M.19, 21, 26, 27-15-8-34 9-17-6-32 13-27-7-34
Left tibia, 175 mm.	N.S.M.22-15-8-34
Left tibia and astragalus articulated.	N.S.M.24-3-8-34
Right tibia, 160 mm.	N.S.M.53-17-9-34
Left metatarsus, 137 mm.	N.S.M.28-17-9-34
Seventeen metatarsi.	N.S.M.10, 12, 14, 15-27-7-34 8-10, -19-9-34 21-3-8-34 26, 27, 29, 37, 38-17-9-34 4, 12-17-6-32 40, 43-15-8-34

Right metatarsus with three tarsals articulated. N.S.M.23-3-8-34

Left metatarsus, 122 mm. N.S.M.45-15-8-34

Right metatarsus and two phalanges articulated. N.S.M.38-15-8-34

Five humeri, eleven radii, twenty-one metacarpi, nine femora, eighteen tibiae and twenty-five metatarsi, N.S.M. Coll., 1935.

Also numerous immature partial limbs, N.S.M. Coll.

Var. from Fairfield Creek, Brown County:

Proximal fragment of ulna F:A.M.31276 From 45 feet above Brule,
and left calcaneum. 1930.

(See questionably associated horns, Section II, page 366; and ramus, Den-
tition Section III, page 423. This paper, *Fig. 39*, horn.)

LIMB SIZE GROUPS III TO V.

(4a') Variation

From Valentine Quarry A, Cherry County, Nebraska

Right radius, 131 mm., and ulna.....	F:A.M. 31956
Left metacarpus, 125 mm.....	31949
Three right and one left metacarpi.....	31949A-D
Left metacarpus, 114 mm.....	31949E
Left metacarpus, 107 mm.....	31956A
Left femur, 132 mm.....	31950
Right metatarsus, 130 mm.....	31952
Two right and one left metatarsi.....	31952A-C
Left metatarsus, 116 mm.....	31952D
	N.S.M.
Left metacarpus, 105 mm.....	7-28-7-30
Left tibia, 167 mm.....	25-8-8-30
Left tarsus, metatarsus, 118 mm., and all superior phalanges.....	23-6-8-30
	<i>Fig. 25B</i> (pes)

Four examples from Fort Niobrara area:

	A.M.
Distal one-fourth right humerus.....	8572B
Distal one-fourth right radius.....	8572C
Right tibia.....	8572D
Proximal one-fourth right metatarsus.....	8572E

LIMB SIZE GROUPS III AND IV.

(6) (?) *M. joraki*, n.sp., referred

From Barstow, California

Distal one-third right hu- merus.	F:A.M.31834	From Hemicyon Stratum, 1931.
Distal one-half right ra- dius.	F:A.M.31834A	1923.
Proximal one-half left ra- dius.	F:A.M.31841B	From Green Hills, first layer above Third Division, 1923.
Left radius with proximal end of ulna, (127.5) mm.	F:A.M.31843	From Hidden Hollow Quarry, 1935.
Left metacarpus, 117.8 mm.	F:A.M.31843A	Hidden Hollow Quarry, 1935.
Right metacarpus.	F:A.M.31842	From Green Hills, 1932.
Proximal one-half right metacarpus.	F:A.M.31841A	From an indefinite locality.
Distal one-half right tibia.	F:A.M.31834B	1923.
Right metatarsus, (132) mm.	F:A.M.31843B	Hidden Hollow Quarry, 1935.
Proximal one-third right metatarsus.	F:A.M.31834C	1923.

Submeryceros, NEW SUBGENUS

LIMB SIZE GROUP V.

(10) (?) *S. minimus*, Var.

From New Mexico

Left metacarpus, 91 mm.

F:A.M.31731

1933.

This paper, Fig. 48.

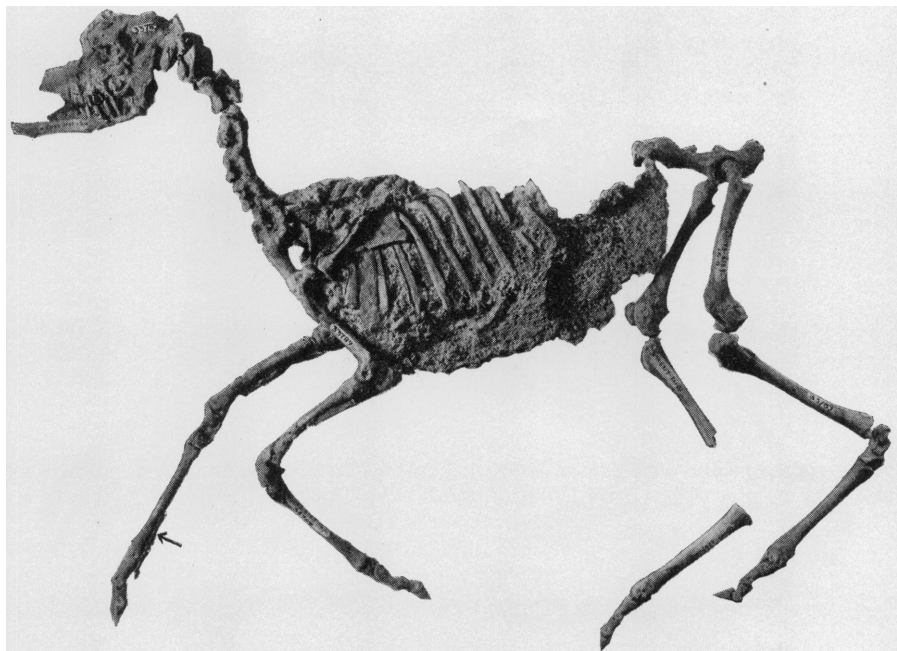


FIG. 48A. *C. (Paracosoryx) wilsoni*, n. subg. and sp., ref. (F:A.M.33789), immature skeleton, from Long Quarry, Sioux County, Nebraska.

× approximately $\frac{1}{4}$ life. Arrow indicates lateral phalanges. (See also Fig. 25B [manus] and pages 316, 351, 447 [footnote] and 462.)

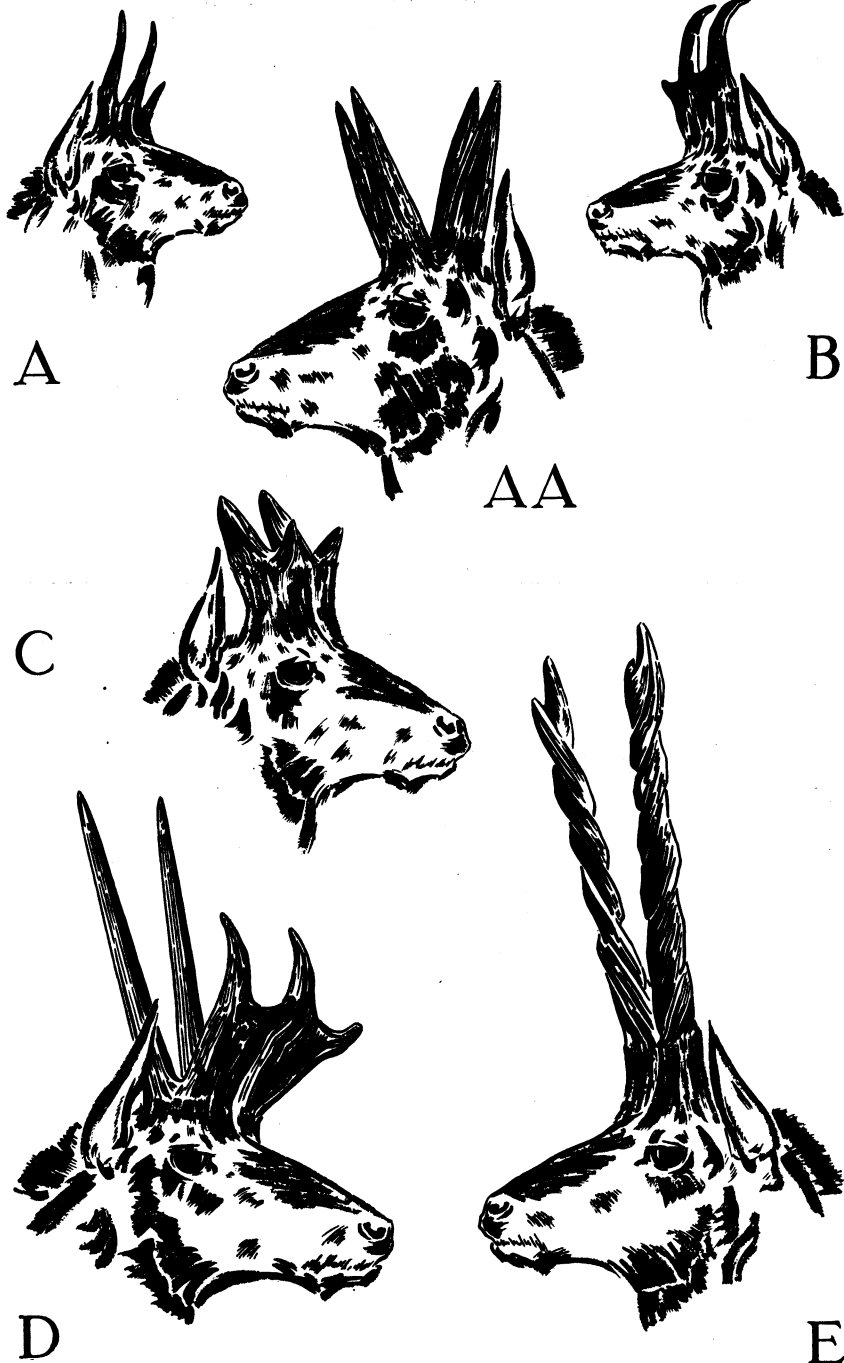


FIG. 49. Pronghorns, Antilocapriini, of the American Late Tertiary and (A, AA and D) Quaternary.

Reconstructions $\times$ approximately $\frac{1}{2}$. (See legend, page 470.)

Subpronghorn (A)

Capromeryx Matthew

Prepronghorn (C)

Plioceros, n.g.

Hay's Pronghorn (D)

Hayoceros, n.subg.

Barbour's Pronghorn (B)

Proantilocapra Barbour and Schultz

Quentin's Pronghorn (AA)

Stockoceros, n.subg.

Spiraled Pronghorn (E)

Ilingoceros Merriam

See *Osbornoceros* reconstruction, Frontispiece, B

DIVISION B.—ANTILOCAPRINI

(A) LATE TERTIARY SECTION

[See (B) Pleistocene Section, page 521.]

Subfamily 3.—*Ilingocerotinae*

IV. OSBORNOCEROS, NEW GENUS

V. ILINGOCEROS MERRIAM

VA. SPHENOPHALOS MERRIAM

Subfamily 4.—*Pliocerotinae*

VI. PLIOCEROS, NEW GENUS

Subfamily 5.—*Stockocerotinae*

(Tertiary portion)

VII. TEXOCEROS, NEW GENUS

Subfamily 6.—*Antilocaprinae*

(Tertiary portion)

VIII. PROANTILOCAPRA BARBOUR
AND SCHULTZ

Frontispiece, B; Figures 49B, C, E, 50, 51, 51A, 52, 52B, and (in part) 26, 45, 52A;
Limbs (in part) 18, 25B, 48

(See Table VII, Species Distribution, page 268; Table X, Mandibular Dentition
Measurements, page 488; and Table XI, Limb Measurements, page 511.)

Statement

There is increasing evidence of the wide diversification of the members of the pronghorn group, Antilocapriini, in the Late Tertiary and Quaternary. The forms are characterized by tall-crowned teeth and tendency to forked horn-cores, which show a slight to marked twist and

total absence of the burrs so typical of the Merycodontini. While there is but one recorded occurrence from Tertiary deposits of an Antilocaprine species with simple unforked pronghorn-like horn-core, remains now are known from a number of widely separated Tertiary areas which are indicative of the occurrence of allied species with forked cores of several different shapes. (See reconstructions, frontispiece, B and Fig. 49B, C, E.) Though certain of the latter horn-cores are recalled in moderate degree in the forked sheath of the pronghorn, and detached teeth to all practical purposes are indistinguishable from the tall-crowned teeth of the latter, it may be presumed that these Tertiary horn-cores and teeth (with the possible exception of *Proantilocapra*) only represent a number of extinct contemporaries of the actual and yet to be discovered ancestors of the several Quaternary and single surviving Recent North American pronghorns. As observed in the Introduction and below in the discussion of the forms from the Pleistocene, the horn-cores of certain individuals of Pliocene *Meryceros* and *Texoceros*, and of Pleistocene *Stockoceros*, might be shown as a morphologic series in which the horn-core bases are consecutively more compressed dorsoventrally and elongated anteroposteriorly. *Plioceros*, with base enlarged and tips greatly reduced, the curious *Osbornoceros*, n.g., and the strongly spiraled horn-cored *Ilingoceros* lie without this series.

The several genera and subgenera—the twisted-cored IV, *Osbornoceros*; V, *Ilingoceros* (and VA, *Sphenophalos*); VI, *Plioceros* and VII, *Texoceros*, with forked horn-cores; and VIII, *Proantilocapra*, with simple cores—are interpreted as representative of at least four distinct subfamilies¹ of a Late Tertiary Section of the Division, Antilocaprine—Ilingocerotinae, Pliocerotinae, Stockocerotinae (in part) and Antilo-

¹ Had not this manuscript been long in print before the receipt of the *Osbornoceros* specimens, the same should have been referred to a separate subfamily, Osbornocerotinae.

FIG. 49. Reconstructions based on:

- (A) *Capromeryx furcifer* Matthew, from the Pleistocene of Hay Springs, Nebraska
- (AA) *Stockoceros (Tetrameryx) onusrosagris* (Roosevelt and Burden), from the Pleistocene of Arizona
- (B) *Proantilocapra platycornea* Barbour and Schultz, from the Tertiary of Cherry County, Nebraska
- (C) *Plioceros crucensis*, n.g. and sp., from the Tertiary of New Mexico
- (D) *Hayoceros falkenbachii*, n.subg. and sp., from the Pleistocene of Hay Springs, Nebraska
- (E) *Ilingoceros alexandrae* Merriam, ref., from the Tertiary of Thousand Creek, Nevada

caprinæ (in part). [For the Pleistocene members of the Stockocerotinæ and Antilocaprinæ proper, see Section (B).] Following a brief discussion of the characters of these genera and subgenera, the species of each are enumerated and the synonymy, types and referred specimens listed in detail. The distribution of the Late Tertiary Antilocaprinæ, as at present recognized, is shown in Table VII, page 268.

The posterior section of a cranium with a slender, twisted and unforked horn-core is taken as the type of a new genus and species, *Osbornoceros osborni* (frontispiece, B and Fig. 51). The specimen, together with other remains of the same form, was secured by the John C. Blick and Charles Falkenbach party late in the fall of 1935 from a restricted exposure of the uppermost beds of the New Mexican pre-Pleistocene. The horn-cores are unique for the American Tertiary, in their slenderness, dorsoventrally compressed and laterally extended bases and narrow twisted and posteriorly sweeping extremities. The inferior cross section is sharp anteriorly, deeply concave externally and rounded posteriorly. The mandibular diastema is shorter and the m_3 third lobe is smaller than the anterior lobes and lacks the accessory vein common to most of the Antilocaprinæ. The mandibular incisors and incisiform /C and the cheek teeth are tall-crowned (the latter approximating Size Group II of the Merycodontini). The new genus, like *Ilingoceros*, is believed to be definitely of the Antilocapridæ rather than the Bovidae. (While there is no evidence of forking, a tendency to this might be shown in the case of an immature horn; possibly the sheath was forked.) The horn-cores of *Ilingoceros* differ from *Osbornoceros* much as those of the Suleman Markhor differ from the domestic goat. The few rami known from the general horizon previous to the discovery of the horn-cores were referred tentatively to *Plioceros*. It is possible that the new genus is represented by fragmental dentitions from other areas in the present collections. The *Osbornoceros* evidence includes examples of the extremely slender, upright-tending adolescent and noticeably heavier, more twisted and possibly more postero-outwardly directed mature horn-cores. The section of a cranium with horn bases shows the frontals to have been as fully depressed, but the horns more upright than indicated in the type. The horn (tip missing) of the type specimen is nearly as large as the largest detached specimens. Several mandibular rami are heavier-proportioned and have larger m_3 s than the average. One specimen is unusually slender. The genus and genotypic species are dedicated to Henry Fairfield Osborn.

The strange spiraled-cored *Ilingoceros* (see reconstruction, Fig. 49E), genotypic species *I. alexandrae* Merriam, from the Thousand Creek Beds, Nevada, is represented in our collections by useful portions of the horn-cores of mature and immature individuals, and a well-preserved ramus secured by the John C. Blick party in the summer of 1934. The tightly spiraled cores of this remarkable Antilocaprine seem to have been directed slightly backward and bowed slightly outward. The twist in the right core is clockwise, as in *Osbornoceros* and the incipient twist in *Plioceros* or the stronger twist in the markhor. The diameter of the shaft seems to diminish unevenly upwardly, with the result that it may be wider in the middle than either proximally or distally. Two diminutive specimens associated with the new remains exhibit a terminal fork highly suggestive of the type of *I. schizoceras*. The latter type may represent no more than an adolescent or female individual of *I. alexandrae*—a possibility previously noted by Merriam. The immature to adolescent specimens tend to be somewhat intermediate to the mature *Ilingoceros* specimens on the one hand and to *Plioceros* on the other, though differing notably from the latter in the anteroposterior narrowness of the shaft and in its proportionate elongation and increase of twist. The *Ilingoceros* horn-core, as seen in the small core of the type of *I. schizoceras*, might be spoken of as a constricted and drawn-out *Plioceros* core. (The core of the type of *Sphenophalos nevadanus*, as judged by the figure, possibly was more like *Ilingoceros* than the remains which have heretofore been referred to *Sphenophalos* [see below] and which here are transferred to *Plioceros*, new genus.) In the newly secured and so far only known ramus, the *Ilingoceros* postsymphysial distance is relatively short, the teeth are very tall-crowned, p_3 - p_4 large and the m_3 talonid reduced. *Ilingoceros* in forked core and teeth is Antilocaprine rather than Antelope. Figures of the Blick immature cores and of the previously described and similar core (type of *I. schizoceras*), together with a reconstruction of the mature horn-core, based on the new Blick specimens and those previously figured, are given on an adjoining plate (Fig. 51A). *Ilingoceros* so far has been found only in the Thousand Creek area from whence specimens of *Sphenophalos* and *Plioceros* as well, it is recalled, are reported.

Knowledge of *Sphenophalos* Merriam to date is confined to the single fragmental type horn-core from Thousand Creek, Nevada. The specimen is figured and described as having a wedge-shaped cross section which is narrowest antero-externally. John C. Merriam (1911, p. 286), in comparing the genotype with a core (U.C.12537) from the same Thousand Creek area, here transferred to *Plioceros* species, observes "...

12537 ... is wider anteroposteriorly, but much thinner transversely than the type specimen. It also differs somewhat from the type in the nature of the region on the posterior side of the base of the horn-core. In the type-specimen, this region is very broadly rounded or nearly flat transversely. In no. 12537 the posterior basal region is relatively much narrower, and a low longitudinal keel is developed on the middle of the posterior surface. In this specimen the tendency of the horn-core to flare anteroposteriorly a short distance above the base is more distinctly shown than in the type material. . . ." (The fragmental genotype of *S. nevadanus* Merriam as figured is not wholly unsuggestive of the New Mexican *Osbornoceros*.)

Plioceros, n.g. (see reconstruction, Fig. 49c), is erected to take a few horn-cores from New Mexico and Nebraska, and somewhat similar remains from Nevada and Oregon. The Nevada and Oregon specimens previously have been allocated in entirety to *Sphenophalos* Merriam. In the genotypic species, *Plioceros blicki*, from New Mexico, the horn-cores are solid, heavy-proportioned, laterally compressed and distally bluntly bifurcate, with the lower and anterior prong depressed outwardly and posteriorly. (The tendency to twist in the right core is clockwise.) The median cross section of the core is slender dumbbell-shaped. The horns are situated on the upper posterior portion of the orbit, sloping slightly backwardly and outwardly and tend to widen upwardly. The genotypic New Mexican core lacks the noticeable basal constriction of the Nevada and Oregon specimens. The constriction in one of the latter is particularly marked through the prominence and anterior welling-out of the front edge above the orbit. Several of the Nevada cores are considerably taller and larger than that from Santa Cruz. The small Nebraskan and the Battleship, New Mexico, specimens exhibit a thickening of the posterior border. Knowledge of the horn-cores of the group is confined so far to remains from New Mexico, Nebraska, Nevada and Oregon. As seen in a referred mandibular ramus from New Mexico (Fig. 52), the diastema is long and the m₁ talonid moderate.

The female *Plioceros* skull is believed to be represented by a specimen from Cherry County (Fig. 26, F:A.M.32101). The teeth are tall and Antilocaprine-like; the diastema long, the premaxilla and anterior ramus slender; the orbits, notable for their prominence outwardly and dorsally, are capped by paired and anteroposterior-stretching excrescences of the frontals; the mid-frontals are domed; the parietal ridges running posterior to the orbits are not united and the posterior as-

pect of the occiput is broad. The low supra-orbital excrescences are interpreted as the rudimentary horns of the female. These tend to occupy the position of the horn-core base of *Plioceros floblairi*, n.sp., and *Meryceros*, rather than of *Proantilocapra*. A posterior thickening of these excrescences would be necessary to produce a horn-core of the form of the latter. (In the relatively low-crowned and short-diastramaed Cervid *Aletomeryx*, the horn-core in both mature and rudimentary state is confined to the posterior orbit.) The new cranium compared to the Crookston *Meryceros* is smaller and shorter, the premaxillæ slenderer, the orbit possibly larger-proportioned, the rudimentary "horns" of very distinctive form and the bullæ smaller. The teeth are heavier-proportioned than in the Crookston specimens and differ from the latter in the larger-proportioned p_3^3 as well as the divided third column of the m_3 . The associated limbs are approximated by elements of the Crookston series.

Texoceros, n.g., is based on a remarkably interesting partial horn-core (Fig. 50) secured by Charles Falkenbach from Oklahoma. The core evidently belongs to the Antilocaprid so well represented by mandibular rami and other remains from that area and from Miami, Texas. The horn, in the development of the forks relative to the size of the basal shaft, stands almost intermediate to Tertiary *Plioceros* and Pleistocene *Stockoceros*. The specimen differs from *Plioceros* in the greater division of the anterior and posterior areas, the median constriction, the wider forking, the elongation and greater rotundity of the forks in cross section and slightly more posterior situation on the orbit. The anterior fork is flexed outwardly and the posterior fork inwardly, as in *Plioceros* and *Meryceros*. As seen in Guymon specimens, the mandibular diastema is of moderate length and the m_3 third lobe and vein expanded. Remains from the Uppermost Pliocene of Eden are very tentatively referred to the genus, which is similarly credited with detached rami from Miami, Texas, and from Yuma County, Colorado, and with the much-questioned teeth of "*Merycodus altidens*" Matthew of Sioux County, Nebraska.

Proantilocapra Barbour and Schultz (see reconstruction, Fig. 49B) is represented alone by the unique type specimen from Cherry County, Nebraska, with horn-core form approaching that of Recent *Antilocapra*. The core differs from the core of the pronghorn mainly in the noticeably smaller size and blunt tuberosus versus attenuated character of the tip. The condition in *Proantilocapra* suggests a possibly primitive state of development in which, while the basal portion of the core was still

covered with skin, a corneous and deciduous sheath arose about the sharp anterior surface. The left horn-core with portion of the orbit, right maxillary dentition and the broad Antilocaprine-like occipital region are well preserved in the type specimen. The mandibular angle is more prominent, the cheek teeth series, though similar, somewhat slenderer and taller-crowned and the p_3 smaller than in the nearest-alike Merycodont [compare Size Group iv, A.M.14109, type of *Cosoryx* (*Paracosoryx*) *sabulonis* (Matthew and Cook)]. The limb elements are somewhat shorter, particularly the humerus and metapodials, and the posterior molars are smaller than corresponding elements in *Ramoceros osborni* (Matthew), from Colorado. The *Proantilocapra* specimen represents a remarkably near approach in the Late Tertiary to Recent *Antilocapra*. The very presence at so early a date of this "advanced" form indicates the gulf that separates the broadly contemporaneous *Plioceros* from direct pronghorn ancestry. The writer has enjoyed the privilege of first-hand examination of the unique type specimen through the kindness of Professor E. H. Barbour.

In the earlier New Mexican, Nebraskan, Virgin Valley of Nevada, and Oregon deposits, the Antilocaprid Merycodontini are found associated with rare Dromomerycine forms; but in the later deposits of the Eden of California, the Thousand Creek of Nevada, the Rattlesnake of Oregon, Miami of Texas, Guymon of Oklahoma, and Yuma County of Colorado, where occur the Antilocaprini forms of the present section, the Merycodontini have not so far been encountered.

Whereas the largest of the mandibular rami allocated to the present *Plioceros* section approximate a large Recent *Antilocapra* in size, small detached m_3 s from the Snake Creek are only very slightly larger than those of *Cosoryx* of Size Group ii; and the m^3 of the small *Plioceros* from Deep Creek, Nebraska, is no larger than the m^3 of a Merycodontine maxilla of Size Group iv. Certain New Mexican and Colorado fragments indicate individuals fully as large or slightly larger than those represented by the average of the Oklahoma and Texas specimens. The series from these two latter areas, as previously noted, witness a normal size variation. It is highly probable that the teeth of the smaller members of this section, even when better known, frequently will be found to be indistinguishable from those of certain of the largest Merycodontini. The teeth from Eden tend to be more compressed laterally and taller-crowned than the average of the teeth from the earlier exposures.

SUMMARY OF ANTILOCAPRINI SPECIMENS

Genus No.		Partial Crania	Horns	Maxillæ	Mandibles	Limbs	Total Elements	Assoc. Elements	Total Specimens
	(A) LATE TERTIARY								
IV	<i>Osbornoceros</i> , n.g.	2	5[2]	6	17	24[1]	54	3	51
V	<i>Ilingoceros</i> Merriam...	1	16	4	7	1	29		29
VA	<i>Sphenophalos</i> Merriam...		2				2		2
VI	<i>Plioceros</i> , n.g.	2	15	5[3]	15[1]	23[2]	60	6	54
VII	<i>Texoceros</i> , n.g.		2	34	142	25	203		203
VIII	<i>Proantilocapra</i> B. & S.	1	[1]	[1]	[1]	[1]	5	4	1
		<u>6</u>	<u>41</u>	<u>60</u>	<u>182</u>	<u>74</u>	<u>353</u>	<u>13</u>	<u>340</u>
	(B) PLEISTOCENE								
IX	<i>Stockoceros</i> , n.subg.	3	9[2]	[2]	3	5	22	4	18
X	<i>Capromeryx</i> Matthew..	3	3	8[1]	10[2]	12[4]	36	7	29
XI	<i>Tetrameryx</i> Lull.		2	3	3		8		8
XII	<i>Hayoceros</i> , n.subg.		1	6	5	12	24		24
XIII	<i>Ceratomeryx</i> Gazin.	2				[2]	4	2	2
XIII	<i>Antilocapra</i> Ord.		2				2		2
		<u>8</u>	<u>17</u>	<u>19</u>	<u>21</u>	<u>31</u>	<u>96</u>	<u>13</u>	<u>83</u>
Total Late Tertiary							<u>353</u>	<u>13</u>	<u>340</u>
Grand Totals							<u>449</u>	<u>26</u>	<u>423</u>

[] associated specimens.

The Tertiary Antilocaprini remains in the present report are divided between the six genera: IV, *Osbornoceros*, new genus; V, the twisted-cored *Ilingoceros* Merriam; VA, the questioned *Sphenophalos* Merriam; VI, *Plioceros*, new genus; VII, *Texoceros*, new genus; and VIII, *Proantilocapra* Barbour and Schultze. Examples of each are illustrated in the adjoining figures (Figs. 50-52B). *Ilingoceros* and *Sphenophalos* originally were referred to the Bovidae. The included remains well may embrace still other genera or subgenera, particularly in the case of the horn-core and dentitions from Eden. Even well-preserved rami may be allocated but doubtfully between the several here-described genera and species. The Pleistocene Antilocaprini are considered in a separate and following section (B).

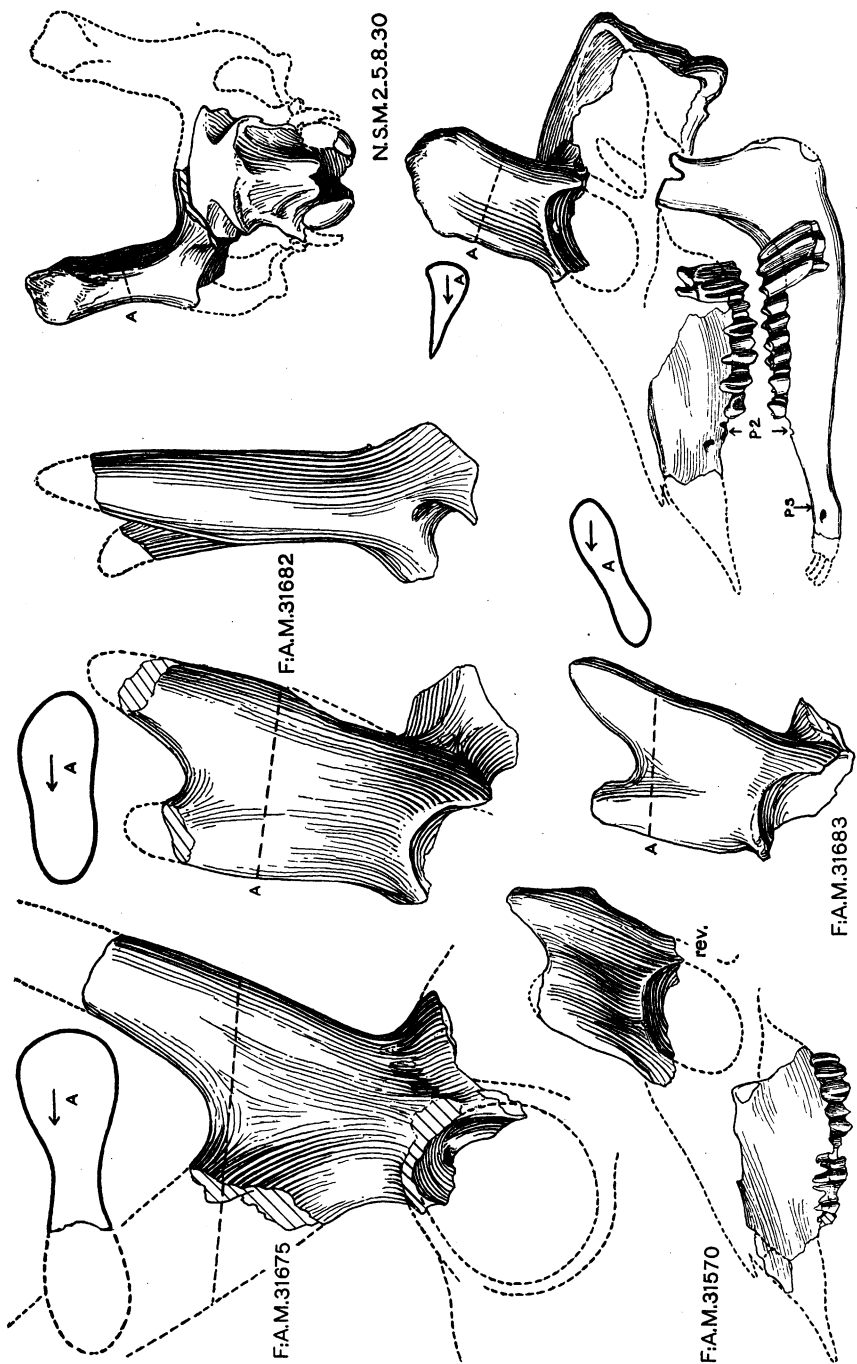


FIG. 50. *Tezoceros*, n.g. (F.A.M. 31675), and *Plioceros*, n.g., horn-cores from Oklahoma, New Mexico and Nebraska; *Proantilocapra* Barbour and Schulz, partial skull and mandible (N.S.M. 2-5-8-30, genotype), from Nebraska.
 X $\frac{1}{4}$. (See legend, page 480.)

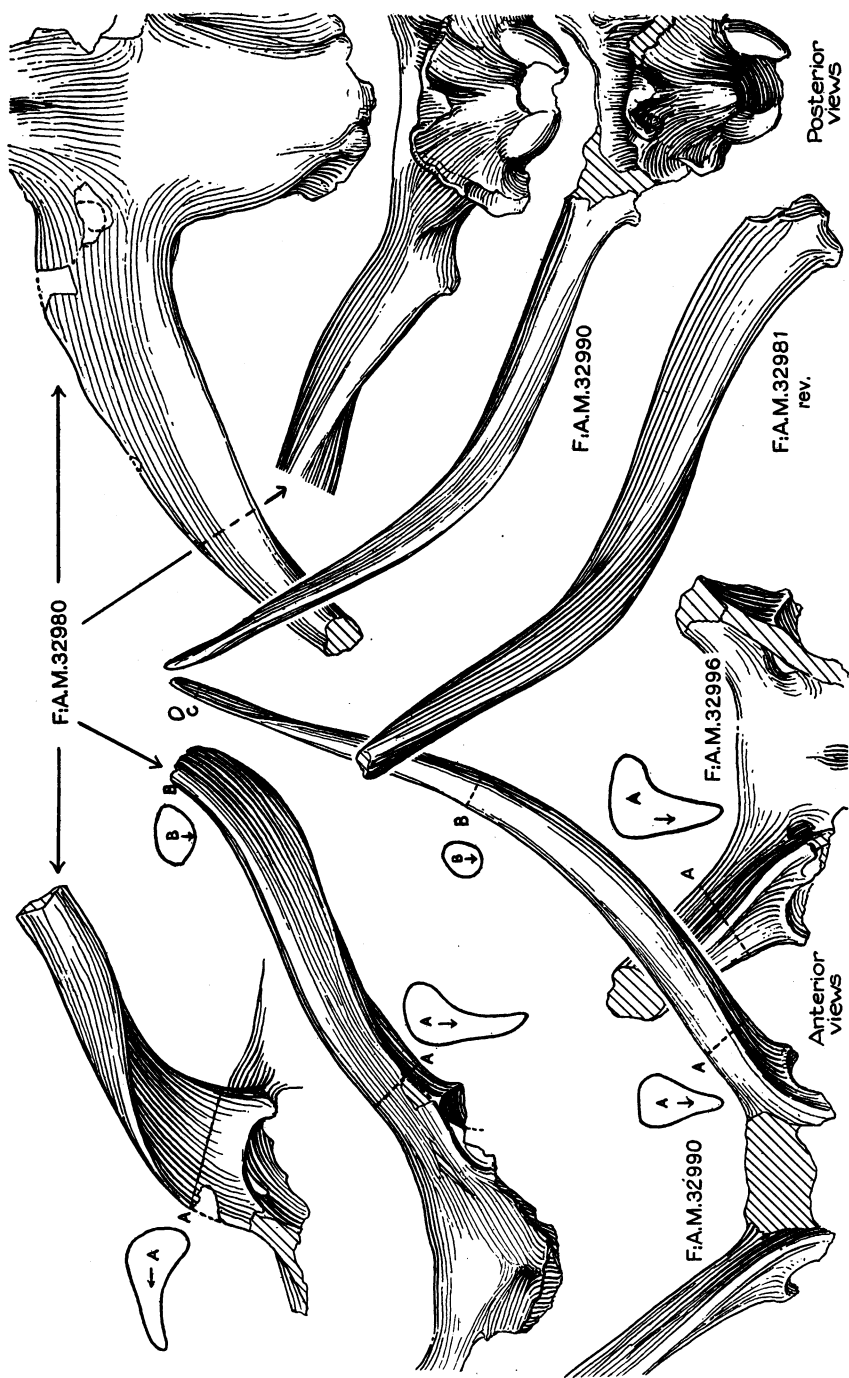


FIG. 51. *Osbornoceros osborni*, n.g. and sp., age and individual variation in crania and horn-cores (F.A.M. 32980 [genotype], 32990 [anterior view, left horn slightly restored from opposite], 32996 [section A rev.] and 32981 [rev.]), from the Uppermost Tertiary, Leyden, New Mexico.

Lateral, anterior, posterior and dorsal views $\times \frac{1}{2}$. A, B, C, cross sections of horn-cores. (See page 490.)

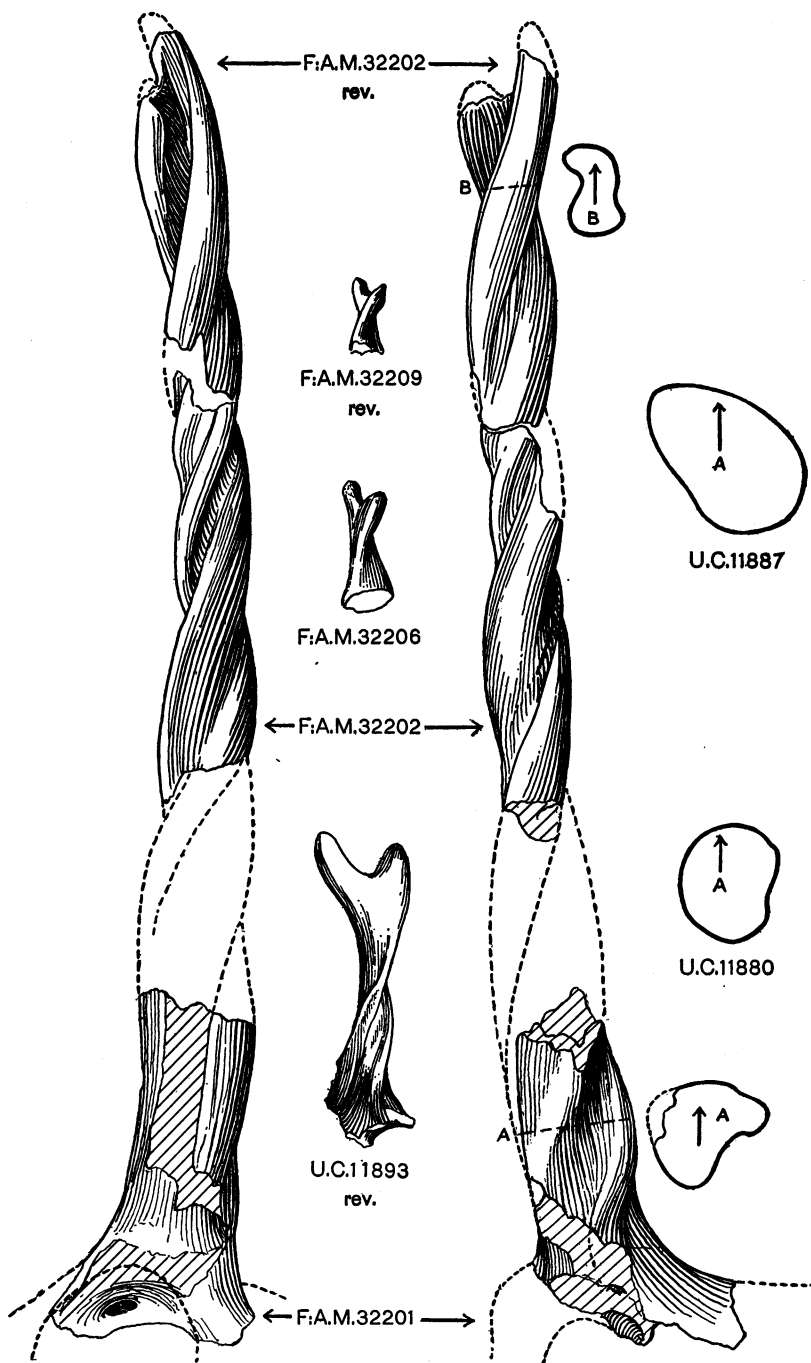


FIG. 51A. *Ilingoceros* Merriam, age and specific variation in horn-cores (and U.C.11887, *Sphenophalos* Merriam cross section), from the Thousand Creek Beds, Nevada.

× $\frac{1}{2}$. (See legend, page 480.)

FIG. 50. *Texoceros*, n.g., and *Plioceros*, n.g., horn-cores; *Proantilocapra* Barbour and Schultz, partial skull and mandible.

× $\frac{1}{2}$. A, cross section of horns; PS, posterior border symphysis.

F:A.M.31675, *Texoceros guymonensis*, n.g. and sp., genotype, from Guymon, Oklahoma.

(See page 501.)

F:A.M.31682 and 31683, *Plioceros blicki*, n.g. and sp., genotype and small ref., from New Mexico.

(See page 495.)

F:A.M.31570, *Plioceros floblairi*, n.sp., type, rev., from Deep Creek, Brown County, Nebraska.

(See page 496.)

N.S.M.2-5-8-30, *Proantilocapra platycornea* Barbour and Schultz, genotype (maxilla rev.), from Cherry County, Nebraska. (After Barbour and Schultz, 1934.)

(See also Fig. 48 [limbs] and page 510.)

FIG. 51A. *Ilingoceros* Merriam, age and specific variation in horn-cores (and U.C.11887, *Sphenophalos* Merriam cross section), from the Thousand Creek Beds, Nevada.

× $\frac{1}{2}$. A, B, cross sections of horns.

F:A.M.32201 and 32202 (tip rev.) combined, lateral and posterior views, and A and B, cross sections; 32209 (rev.) and 32206, immature, of *Ilingoceros alexandræ* Merriam, ref.

(See page 492.)

U.C.11893, *Ilingoceros schizoceras* Merriam, type, rev. (After Merriam, 1911.)

(See page 493.)

U.C.11880, *Ilingoceros alexandræ* Merriam, cross section of genotype. (After Merriam, 1909.)

(See page 492.)

And for comparison:

U.C.11887, *Sphenophalos nevadanus* Merriam, cross section of genotype. (After Merriam, 1909.)

(See page 494.)

Summary of Named Species

The six Late Tertiary genera and sixteen species and subspecies, whose synonymy and details are listed on subsequent pages, may be briefly considered under four subfamilies:

SUBFAMILY 3.—ILINGOCEROTINÆ

IV. *Osbornoceros*, new genus. (Size Groups II and III.)

Horn-core base compressed, extremity twisted.

(1) *Osbornoceros osborni*, n.g. and sp., from New Mexico.

GENOTYPE.—Posterior half of cranium with left horn-core, F.A.M. 32980. This paper, *Fig. 51*.

V. *Ilingoceros* Merriam. (Size Group I+.)

Horn-core spiraled.

(1) *Ilingoceros alexandræ* Merriam, genotypic species, from Thousand Creek, Nevada.

GENOTYPE.—Basal portion of left horn-core, U.C.11880. This paper, *Fig. 51A* (cross section).

(1a) *Ilingoceros schizoceras* Merriam, from Thousand Creek, Nevada.

TYPE.—Right horn-core, U.C.11893. This paper, *Fig. 51A*.

VA. *Sphenophalos* Merriam.

Questioned.

(1) *Sphenophalos nevadanus* Merriam, genotypic species, from Thousand Creek, Nevada.

GENOTYPE.—Base of horn-core attached to portion of skull, U.C. 11887. This paper, *Fig. 51A* (cross section).

(1a) *Sphenophalos* species, Merriam, Stock and Moody, from the Rattlesnake, Oregon.

EXAMPLE.—Basal portion of horn-core, U.C.22428.

SUBFAMILY 4.—PLIOCEROTINÆ

VI. *Plioceros*, new genus. (Size Groups I to III.)

Horn-core base laterally compressed and tips short.

- (1)
- Plioceros blicki*
- , n.g. and sp., from New Mexico. (s.g. I.)

GENOTYPE.—Pair of horn-cores, F:A.M.31682. This paper, *Fig. 50*.

- (2)
- Plioceros floblairi*
- , n.sp., from Brown County, Nebraska. (s.g. II TO III.)

TYPE.—Left horn-core and associated maxillæ, F:A.M.31570. This paper, *Fig. 50*.

- (2a)
- Plioceros dehlini*
- , n.sp., from Snake River, Cherry County, Nebraska. (s.g. III.)

TYPE.—Skull, mandible and nearly complete limbs, F:A.M.32101. This paper, *Fig. 26*.

- (2b-c) (?)
- Plioceros*
- vars., from southern Nebraska and Kansas.

Are exemplified only in limb elements, see Limb Section, page 517.
From: (2b) Hitchcock County, Nebraska, and (2c) Kansas.

- (3)
- Plioceros*
- species, from Harper, Malheur County, Oregon.

EXAMPLE.—Left horn-core, C.I.T.16.

- (3a) Smaller var., from Rome, Malheur County, Oregon.

EXAMPLE.—Right horn-core, C.I.T.396.

- (4)
- Plioceros*
- species and vars., from Thousand Creek, Nevada.

EXAMPLES.—Horn-cores, C.I.T. and U.C. collections.

SUBFAMILY 5. STOCKOCEROTINÆ
(Tertiary Portion)VII. *Texoceros*, new genus. (Size Groups I, II and IV.)

Horn-core base deeply cleft and forks long.

(The small size of the molars in (?) *T. minorei* and elongation of the diastema in (?) *T. vughani* and (?) *T. edensis* indicate the presence of a group or groups apart from *Texoceros*, and possibly more closely resembling *Plioceros*.)

- (1) *Texoceros guymonensis*, n.g. and sp., from Guymon, Texas County, Oklahoma. (s.g. I and II.)

GENOTYPE.—Left horn-core, F:A.M.31675. This paper, *Fig. 50*.

- (1a) *Texoceros texanus* (Hesse), from Hemphill County, Texas. (s.g. I.)

TYPE.—Left ramus with p_1 - m_2 , U.C.30337.

- (1b) (?) *Texoceros minorei*, n.sp., from Guymon, Oklahoma. (s.g. IV.)

TYPE.—Left fragment with p_1 - m_2 , F:A.M.31668. This paper, *Fig. 52*.

- (2) (?) *Texoceros vauhani*, n.sp., from Wray, Yuma County, Colorado. (s.g. II.)

TYPE.—Mandibular symphysis, F:A.M.31312A. This paper, *Fig. 52*.

- (3) (?) *Texoceros* species, from Benson, Arizona.

EXAMPLE.—Maxillary teeth, F:A.M.32060.

- (4) (?) *Texoceros altidens* (Matthew), from "Upper Snake Creek," Sioux County, Nebraska. (s.g. I-.)

TYPE.—Right ramal fragment, A.M.18981.

- (5) (?) *Texoceros edensis*, n.sp. (s.g. I), and var. A, from the Uppermost Pliocene, Eden, California.

TYPE.—Left ramus, F:A.M.31765. This paper, *Fig. 52B*.

SUBFAMILY 6.—ANTILOCAPRINÆ
(Tertiary Portion)

VIII. *Proantilocapra* Barbour and Schultz. (Size Group III.)

Horn-core tending laterally compressed and blade-like.

- (1) *Proantilocapra platycornea* Barbour and Schultz, genotypic species, from Cherry County, Nebraska.

GENOTYPE.—Partial skull, mandible and skeletal elements, N.S.M. 2-5-8-30. This paper, *Figs. 48* (limbs), *50* (partial skull and ramus).

[See (2) Pleistocene Section, Antilocapriini, page 521.]

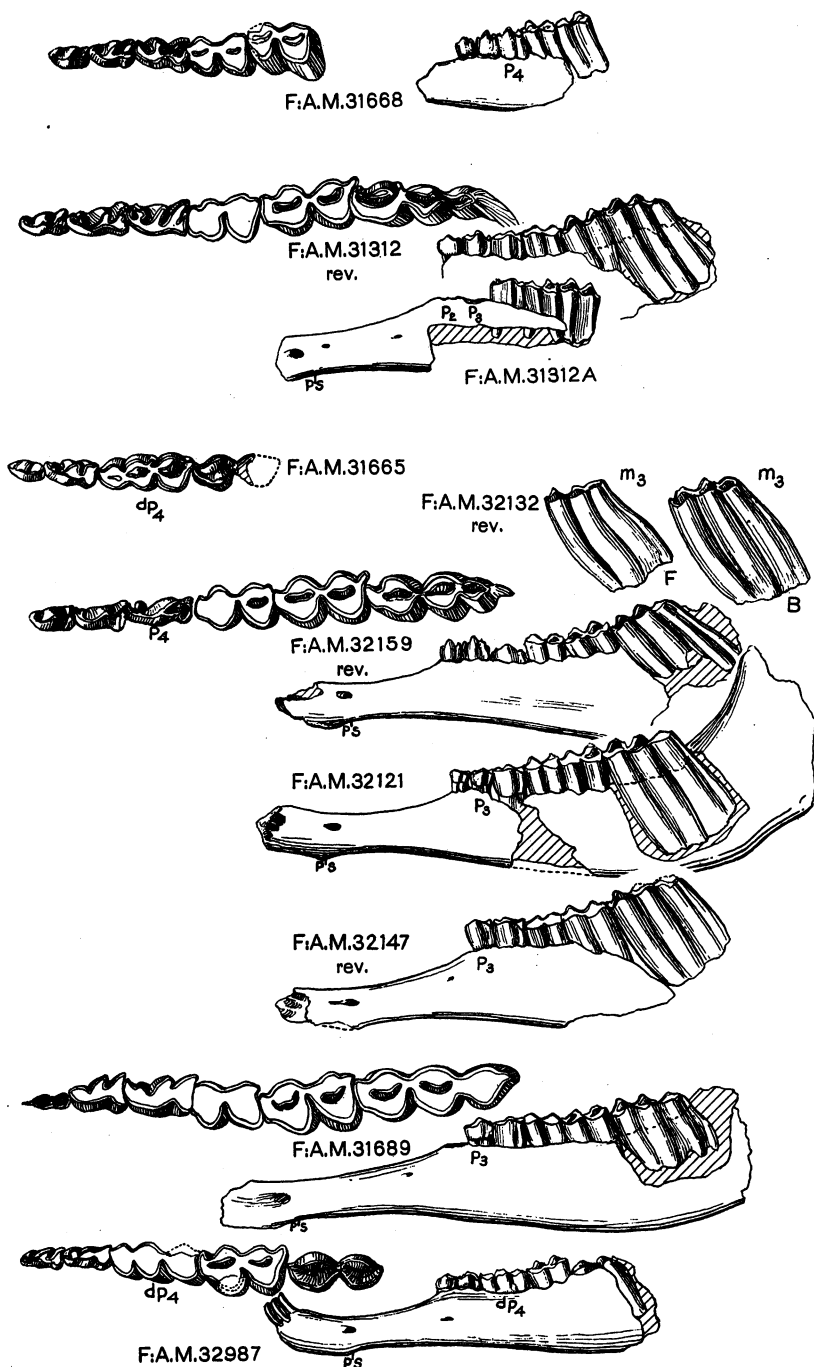


FIG. 52. *Texoceros*, n.g., *Plioceros*, n.g. (F:A.M.31689) and *Osbornoceros*, n.g. (F:A.M.32987), from the Late Tertiary, mandibular dentitions compared. Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. (See legend, page 487.)

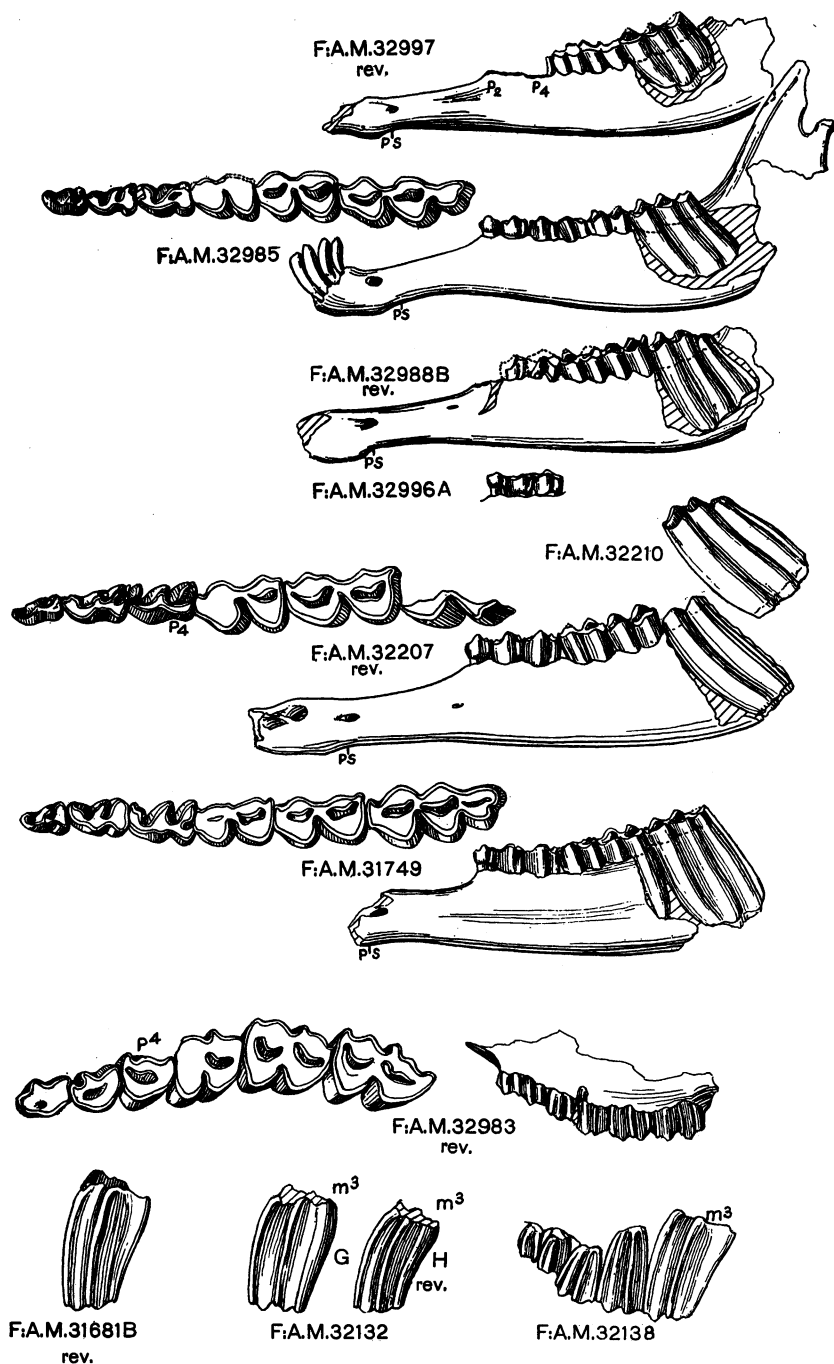


FIG. 52A. *Osbornoceros*, n.g., *Ilingoceros* Merriam (F.A.M. 32207 and 32210), *Plioceros*, n.g. (F.A.M. 31681B), *Texoceros*, n.g. (F.A.M. 32132G, H, and 32138), from the Late Tertiary, and *Capromeryx* Matthew (F.A.M. 31749), from the Pleistocene, mandibular and maxillary dentitions compared.

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. (See legend, page 487.)

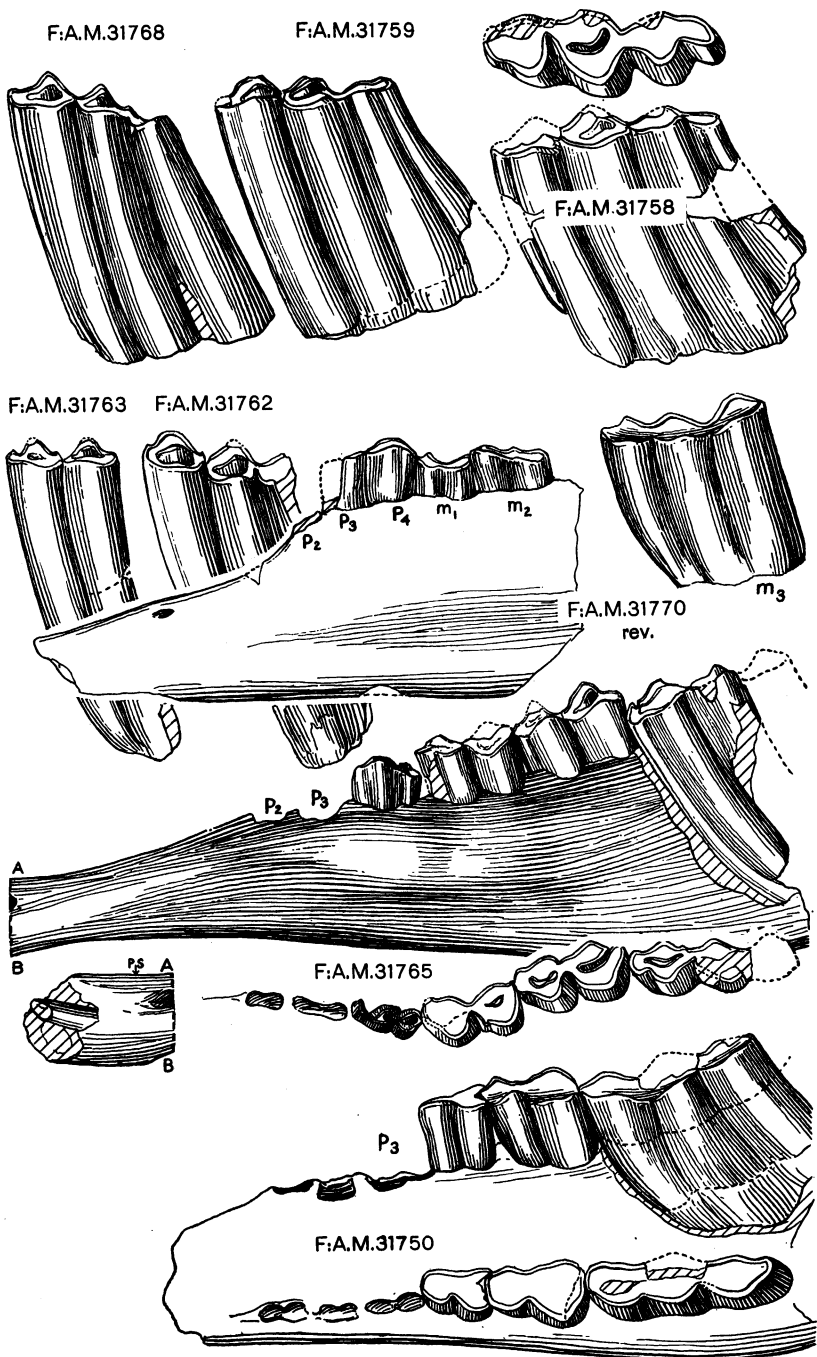


FIG. 52B. (?) *Texoceros edensis*, n.sp., age and individual variation in mandibular dentitions (F:A.M.31768, 31759, 31758, 31763, 31762, 31770 [var. A, rev.], 31750 [rev.] and 31765, type), from Uppermost Pliocene, Eden, California.
 X 1. PS, posterior border symphysis. (See pages 509, 508.)

FIGS. 52 AND 52A. *Texoceros*, n.g., *Plioceros*, n.g., *Osbornoceros*, n.g., *Ilingoceros* Merriam (Late Tertiary) and *Capromeryx* Matthew (Pleistocene), mandibular and maxillary dentitions compared.

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. PS, posterior border symphysis.

FIG. 52. F:A.M.31668, (?)*Texoceros minorei*, n.sp., type, from Texas County, Oklahoma.

(See page 506.)

F:A.M.31312 and A, (?)*Texoceros vaughani*, n.sp., ref., rev., and type, from Yuma County, Colorado.

(See page 506.)

F:A.M.31665, 32132B (rev.) and F (rev.), 32159 (rev.), 32121 and 32147 (rev.), *Texoceros guymonensis*, n.g. and sp., ref., from Texas County, Oklahoma.

(See pages 504, 501.)

F:A.M.31689, *Plioceros blicki*, ref., from San Ildefonso, New Mexico.

(See page 495.)

F:A.M.32987, *Osbornoceros osborni*, n.g. and sp., ref., from Leyden, New Mexico.

(See page 491.)

FIG. 52A. F:A.M.32997 (rev.), 32985, 32988B (rev.), 32996A and 32983 (rev.), *Osbornoceros osborni*, n.g. and sp., ref., from Leyden, New Mexico.

(See pages 491, 490.)

F:A.M.32207 (rev.) and 32210, *Ilingoceros alexandrae* Merriam, ref., from Thousand Creek, Nevada.

(See page 493.)

F:A.M.31749, *Capromeryx furcifer* Matthew, var., from Stegomastodon Quarry, Brown County, Nebraska.

(See page 529.)

F:A.M.31681B, *Plioceros blicki*, ref., rev., from Santa Cruz, New Mexico.

(See page 495.)

F:A.M.32132G, H (rev.) and 32138, *Texoceros guymonensis*, n.g. and sp., ref., from Texas County, Oklahoma.

(See page 504.)

TABLE X
ANTILOCAPRINI MANDIBLES
COMPARATIVE MEASUREMENTS AND RATIOS
[Millimeters]

	Stage of tooth	Collection No.	Tooth	Wear	$\frac{m_3}{PS\ d.}$	$\frac{p_1-p_4}{m_1-m_3}$	$\frac{p_2}{p_4}$	$\frac{p_2}{m_3}$	$\frac{p_3}{p_4}$	$\frac{p_3}{m_3}$	See Fig.
LATE TERTIARY:											
<i>Ilingoceros alexandraz</i> Merriam, ref., Thousand and Cr., Nev.....	I+	F.A.M. 32207	M		$\frac{((23.))}{31.} = ((74))\%$	$\frac{25.5}{((46.))} = ((55))\%$	$\frac{7.}{9.7} = 72\%$	$\frac{((30))}{9.7}\%$	$\frac{9.1}{9.7} = 94\%$	$((40))\%$	52A
<i>Osbornoceros osborni</i> , n.g. and sp., ref., Round Mt., N. Mex.....	II	32985	W		$\frac{16.4}{25.5} = 64$	$\frac{20.}{35.} = 57$	$\frac{5.7}{(8.)} = (71)$	35	$\frac{7.}{(8.)} = (88)$	43	52A
<i>Plioceros blicki</i> , n.g. and sp., ref., San Ildefonso, N. Mex.....	I	31689	W		$\frac{22.}{40.} = 51$	$\frac{((23.))}{42.} = ((55))$	$\frac{9.2}{4.7} = 76$	25	$\frac{7.5}{9.2} = 82$	34	52
<i>P. flabairi</i> , n.sp., ref., Brown Co., Nebr...	II	31190	W++		$\frac{19.}{35.} = 54$	$\frac{16.}{37.} = 43$	$\frac{4.7}{6.2} = 76$	28	$\frac{5.5}{6.2} = 89$	29	45
<i>P. dellini</i> , n.sp., type (♀), Cherry Co., Nebr.....	III	32101	M+		$\frac{15.}{22.4} = 67$	$\frac{18.6}{33.6} = 55$	$\frac{4.2}{8.3} = 51$	26	$\frac{6.3}{8.3} = 76$	42	26
* <i>Proantilocapra platycornea</i> B. and S., genotype, Cherry Co., Nebr.....	"	N.S.M. 2-5-8-30	M+		$\frac{11.5}{18.4} = 63$	$\frac{18.}{30.6} = 59$	$\frac{7.}{7.}$	50	$\frac{6.}{7.} = 86$	52	50
(?) <i>Tetoceros edensis</i> , n.sp., type, Eden, Calif.....	I	F.A.M. 31765	M+		$\frac{39.}{19.}$	$\frac{((24.))}{42.} = ((48))$	$\frac{9.}{9.}$	52B	$\frac{9.}{9.}$	52B	52B
<i>T. texanus</i> (Hesse), ref., Hemphill Co., Tex.	"	31651	M++		$\frac{21.}{(30.5)} = (69)$	$\frac{((20.))}{42.} = ((48))$	$\frac{9.}{(lost)}$	52	$\frac{7.5}{9.} = 83$	(36)	52
<i>T. guymonensis</i> , n.g. and sp., ref., Texas Co., Okla.....	"	32147	W+		$\frac{20.5}{34.} = 60$	$\frac{20.4}{41.} = 50$	$\frac{5.3}{8.7} = 61$	26	$\frac{6.7}{8.7} = 77$	33	52
"	"	32121	M+								

<i>T. guymonensis</i> , ref. (cont.).....	"	32122	M+	19. 30.5	= 62	19.5 38.5	= 51	5.3 7.9	= 67	28	6.8 7.9	= 86	36
".....	"	32154	M+	(19.) 31.	= (61)	21. (39.)	= (54)	5.9 8.3	= 71	(31)	6.9 8.3	= 83	(36)
".....	II	32161D	M+	18.7 25.5	= 73	((18.3)) 39.5	= ((46))	7.6			6.3 7.6	= 83	34
".....	"	32151	M+	(17.5)		20. (36.)	= (56)	5.7 7.9	= 72	(33)	7.1 7.9	= 90	(41)
(?) <i>T. vaughani</i> , n.sp., ref., Yuma Co., Colo.....	"	31312	M	17.		23. 39.	= 59	6.3 8.8	= 72	37	8.2 8.8	= 93	48
(?) <i>T. minorei</i> , n.sp., type, Texas Co., Okla. IV	IV	31668	M+					5.1 7.1	= 72		6. 7.1	= 85	52
PLEISTOCENE:													
† <i>Capromeryx furcifer</i> Matthew, genotype, Sheridan Co., Nebr.....	II	A.M. 2771	M+	16.9		16.9 36.	= 47	4.3 7.2	= 60	25	6. 7.2	= 83	36
<i>C. furcifer</i> var., Brown Co., Nebr.....	I	F.A.M. 31749	M+	17.5 31.	= 56	23.5 41.	= 57	6. 8.8	= 68	34	7.7 8.8	= 88	44
<i>Hayoceros falkenbachii</i> , n.subg. and sp., ref., Sheridan Co., Nebr.....	A-I	A.M. 2772	M+	51.				10.			(9.2) 10.	= 92	54
RECENT (for comparison):													
<i>Antilocapra americana</i> Ord, ref. (♂), Wyo..	"	A.M.(M.) 75243	M	21. 55.	= 38	29. 48.	= 60	7.2 12.	= 60	34	9.8 12.	= 82	47
" (♀), Mont..	"	11106	M	22.5 40.	= 56	31. 50.	= 62	8.5 12.	= 71	38	11. 12.	= 92	49
" " " " " "	"	11096	M+	23.5 52.	= 45	24. 48.	= 50	5.5 10.	= 55	23	7.8 10.	= 78	33

() Approximate; (()) estimated.

* Measurements taken partly from Fig. 50; † measurements taken partly from Fig. 54.

Detailed Lists of Types, Referred Specimens, and Synonymy

Total available specimens, 340: *Osbornoceros*, 51; *Ilingoceros*, 29; *Sphenophalos*, 2; *Plioceros*, 54; *Texoceros*, 203; *Proantilocapra*, 1.

For size groups, see summary of named species, pages 481-483.

IV. OSBORNOCEROS, NEW GENUS

Reconstruction, Frontispiece, B

The genus, as remarked above, is represented by a fine series of skull portions, horn-cores, dentitions and limbs from the uppermost beds of the Santa Fé area. As yet it is elsewhere unrecognized.

(1) *Osbornoceros osborni*, new genus and species

From the Vicinity of Leyden, New Mexico

GENOTYPE.—Posterior one-half of cranium with left horn-core, portion of frontals and the superior border of the left orbit. *Fig. 51* F:A.M. 32980

REFERRED FROM TYPE LOCALITY.—

SKULLS, HORNS OR MAXILLÆ

Portion of cranium with bases of both horn-cores. (See possibly associated mandible, F:A.M.32996A.).....	<i>Fig. 51</i>	32996
Right horn-core (nearly complete). Slightly larger than type.....	<i>Fig. 51</i>	32981
Left horn-core (end missing).....		32982
Posterior portion of skull with both horn-cores of adolescent individual. (Horns extremely slender.).....	<i>Fig. 51</i>	32990
Palate with both p^2 - m^2 s.....	(w+)	32983
	<i>Fig. 52A</i>	
Palate with both p^1 - m^1 s.....	(w+)	32984
Left maxilla with p^2 - m^2 (br.).....		32990A
Right maxilla with p^1 - m^1 (br.).....		32990B
Left maxilla with dp^1 - m^1 (erupting).....		32990C

MANDIBULAR SPECIMENS

Right ramus with symphysis, broken dp_2 - dp_4 , and m_1 - m_2 (erupting).....	<i>Fig. 52A</i>	32988B
Partial left ramus with p_2 (br.), m_2 - m_3 and alveoli.....	(w++)	32986
Left fragment with p_4 - m_2 and roots of p_2 - p_3	(w)	31687
Nearly complete mandible with portions of symphysis and p_2 - m_2	(w+)	32996A
	<i>Fig. 52A</i>	
Left ramus with p_2 (br.)- m_2	(w)	31686

		F:A.M.
Left ramus with portion of symphysis and p_2-m_3	(w++)	32999
Both rami with p_4-m_3 (br.).....	(w++)	32999A
Mandible with three /Is, /C and p_2-m_3 . (Moderate-sized.).....	(w)	32985
	Fig. 52A	
Right ramus with symphysis, alveoli and m_1 (br.)- m_3 . (Slender.).....	(w)	32997
	Fig. 52A	

Seven immature:

Left ramus with dI_2 -/C and dp_3-m_2 (erupting).....	Fig. 52	32987
Left ramus with dp_2-m_2		32988
Left ramus with portions of symphysis, dp_2-m_2 (erupting).		32988C
Partial right ramus with dp_2-m_2		32988D
Right fragment with dp_2-m_2 (dp_4 br.).....		32988E
Left fragment with dp_3-m_2 (erupting).....		32988F
Right partial ramus with dp_4-m_2 (erupting).....		32988A

A number of fragmental mandibular and maxillary specimens, F:A.M. Coll.

Two metatarsi, etc. (See Limb Section, pages 514-515.)

Two unguals (unusually compressed laterally), F:A.M. Coll.

QUESTIONABLY REFERRED FROM POSSIBLY CONTEMPORANEOUS POCKETS.—

Right maxilla with p^2-m^1 and m^2 . (From W. Rio Grande, above San Juan.) (See associated limb elements, page 515.).....		32989
Left fragment with p_4-m_3 . (From E. Alcalde, 1927.)....	(w)	31685

V. ILINGOCEROS MERRIAM

Reconstruction, Fig. 49E

The genus, as observed on a foregoing page (see discussion, page 472), includes the genotypic and a small referred species.

(1) *Ilingoceros alexandræ* Merriam, genotypic species

From Thousand Creek Beds, Nevada

Ilingoceros alexandræ MERRIAM, 1909, Univ. Cal. Pub. Bull. Dept. Geol., V, p. 320, Figs. 1-5; 1911, *ibid.*, VI, p. 299, Figs. 78-80.

GENOTYPE.—Basal portion of left horn-core with part of frontal.	U.C.11880	From Thousand Creek beds. Figured by Merriam, 1909, Figs. 1 and 4; 1911, Fig. 79; this paper, <i>Fig. 51A</i> (cross section, after Merriam, 1909).
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RECORDED BY JOHN C. MERRIAM FROM TYPE LOCALITY.—

Left horn-core base. "Questioned."	U.C.11894	Figured by Merriam, 1909, Fig. 5.
Frontal saddle. " <i>I. species</i> ."	U.C.11882	Figured by Merriam, 1909, Fig. 3.
Horn-core section. "Form B."	U.C.11892	Figured by Merriam, 1909, Fig. 2; 1911, Fig. 80.
Fragment of core.	U.C.11886	Figured by Merriam, 1911, Figs. 78a, b.
Questioned teeth.	U.C.12613, 12605, 12610, 12604, 19418	Figured by Merriam, 1911, Figs. 68–72, under " <i>Sphe-nophalos</i> or <i>Ilingoceros</i> ."

[Compare metatarsus (U.C.19419), figured by Merriam, 1911, Fig. 74, under *I. schizoceras*.]

NEW EVIDENCE SECURED BY JOHN C. BLICK PARTY (1934).—

HORNS

Pair of horn-core bases, together with two distal sections of horn-core.	F:A.M.32201 F:A.M.32202	This paper, <i>Fig. 51A</i> . This paper, <i>Fig. 51A</i> .
Long section of ?right horn-core.	F:A.M.32203	
Three basal horn fragments.	F:A.M.32204,A,B	
Three disintegrated horn sections.	F:A.M.32205,A,B	
Two diminutive forked horn-cores.	F:A.M.32206 and 32209	This paper, <i>Fig. 51A</i> .

[Interpreted as representing immature individuals. Specimens highly suggestive of the larger core of the type of the Merriam referred species (see following), which tentatively is interpreted as representing an adolescent or female individual of the genotypic species.]

DENTITIONS

Right ramus with /Is alveoli (br.), p ₂ -m ₃ (br.); and partial left ramus with p ₄ , m ₁ (br.), m ₂ . (M)	F:A.M.32207	This paper, <i>Fig. 52A</i> .
Two m ₂ s.	F:A.M.32208 and 32210B	
Left m ₃ .	F:A.M.32210	This paper, <i>Fig. 52A</i> .
Right m ₃ .	F:A.M.32210A	
p ⁴ -m ¹ .	F:A.M.32210C	
And fragments.		

(1a) *Ilingoceros schizoceras* Merriam

From Thousand Creek, Nevada

Ilingoceros, form C, MERRIAM, 1909, Univ. Cal. Pub. Bull. Dept. Geol., V, p. 325, Fig. 6.*Ilingoceros schizoceras* MERRIAM, 1911, *ibid.*, VI, p. 292, Figs. 73-76.

TYPE.—Right horn-core. (Small-sized.)	U.C.11893	From Thousand Creek beds. Figured by Merriam, 1909, Fig. 6; 1911, Fig. 73; this paper, <i>Fig. 51A</i> (after Merriam, 1911).
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REFERRED.—

Right metatarsus. (See Limb Section, page 515.)	U.C.19419	Figured by Merriam, 1911, Fig. 74.
--	-----------	---------------------------------------

VA. SPHENOPHALOS MERRIAM .

The genus (as discussed above) is only indefinitely characterized in the fragmental genotype from Thousand Creek. (The figured cross section of the fragmental horn is even suggestive of the cross section of *Osbornoceros*. A careful comparison of actual specimens is to be desired.)

(1) *Sphenophalos nevadanus* Merriam, genotypic species

From Thousand Creek, Nevada

Sphenophalos nevadanus MERRIAM, 1909, Univ. Cal. Pub. Bull. Dept. Geol., V, p. 325, Fig. 7. Referred FURLONG, 1932, Carn. Inst. Wash. Pub. 418, p. 29, Pl. iv, Fig. 8.

GENOTYPE.—Base of horn-core attached to portion of skull.

U.C.11887

Figured by Merriam, 1909, Fig. 7; by Furlong, 1932, Pl. iv, Fig. 8; this paper, Fig. 51A (cross section, after Merriam, 1909).

John C. Merriam figures the horn as tilted posteriorly and as of egg-shaped cross section, with the apex lying above the mid-orbit. (Exact characters in question.)

(1a) *Sphenophalos* species, Merriam, Stock and Moody

From the Rattlesnake, Oregon

Sphenophalos sp., MERRIAM, STOCK AND MOODY, 1925, Carn. Inst. Wash. Pub. 347, p. 90, Fig. 43, a, b and c.

EXAMPLE.—Basal portion of horn-core with fragment of orbit.

U.C.22428

Figured by Merriam, Stock and Moody, 1925, Fig. 43, a, b and c.

As seen in the figure, the specimen seems to differ in postorbital contour from all specimens known to the writer. U.C.22428 may possibly represent yet another distinct genus or subgenus.

VI. *PLIOCEROS*,¹ NEW GENUS

Reconstruction, Fig. 49c

Plioceros, n.g., is recognized from New Mexico, Nebraska, Nevada and Oregon, and tentatively from Kansas. (See discussion, page 473.) The types of the some five species and several geographical varieties represented by horn-cores (one by skull and mandible and associated limbs), and the two additional occurrences suggested by limb elements,

¹ *Plioceros* is used advisedly, with the knowledge that "*Plioceros*" has been employed by Quatrefages (1867, Hist. Nat. des Annelés, p. 381) for a genus of Vermes which is not in current use.

are enumerated on a preceding page (page 482). The detailed evidence is as follows:

(1) *Plioceros blicki*, new genus and species

From New Mexico

GENOTYPE.—Pair of horn-cores showing portions of orbit and frontal bone.	F:A.M.31682	From Santa Cruz. This paper, <i>Fig. 50</i> .
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REFERRED.—

Left horn-core of small or immature individual, and possibly associated phalanx.	F:A.M.31683	From Battleship Mountain, 1928. This paper, <i>Fig. 50</i> .
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REFERRED RAMI (size large, tooth series only slightly shorter but diastema considerably longer than in Nevada *Ilingoceros* referred, F:A.M.32207, and Oklahoma *Texoceros*).—

Left ramus with symphysis, p_2 alveolus, p_3 - m_3 . (w)	F:A.M.31689	From San Ildefonso, 1935. This paper, <i>Fig. 52</i> .
P.S.- m_3 inclusive = 108 mm. (Size Group 1)		
p_2 alveolus- m_3 = 65 (versus F:A.M.31684 = 64 mm.)		

Right ramus with p_2 and p_3 (br.)- m_3 . (w)	F:A.M.31689A	From 1st wash, Santa Cruz, 1935.
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TENTATIVELY REFERRED (certain specimens may represent *Merycodontini*, Size Group II, forms), size fully equaling Colorado and largest Oklahoma remains of *Texoceros*.—

Partial right ramus with p_4 - m_3 , alveoli of p_2 - p_3 . (w)	F:A.M.31684	From Taos Road, 1925.
Left fragment with p_4 (br.) and m_1 - m_3 (br.).	F:A.M.31680	From Lower Pojuaque Bluffs, 1928.
Two detached m 's.	F:A.M.31681A and B	From Santa Cruz, 1928. B, this paper, <i>Fig. 52A</i> .
Left fragment with m_1 - m_3 , and p_4 germ. (A)	F:A.M.30921	From Otowi Bridge, 1928.
Right fragment with m_1 - m_3 (teeth br.). (w)	F:A.M.31688	From Leyden Quarry, 1936.
(Somewhat larger and heavier than above and notably larger than <i>Osbornoceros</i> from the same area.)		

(Metapodials indicate the presence of smaller individuals approximating *P. dehlini* size [Limb Size Group III].)

(2) *Plioceros floblairi*, new species

From Brown County, Nebraska

TYPE.—Left horn-core and associated maxillæ with p^2 - m^3 . (w) F:A.M.31570 From Deep Creek, 1930.
This paper, *Fig. 50*.

Length of tooth series actually shorter through wear, but proportions very suggestive of *Plioceros dehlini*, n.sp., cranium (F:A.M.32101) from Cherry County, Nebraska. Horn-core is the smallest so far known of *Plioceros* form. Morris F. Skinner reports both F:A.M.31570 and 32101 as coming from top of section.

TENTATIVELY REFERRED.—

(a) From Fairfield Falls Quarry:

It is possible that a peculiar mandibular ramus (F:A.M.31190) from Fairfield Falls Quarry, which in unusually elongate diastema and reduced premolars recalls specimens of the smaller genus *Longirostromeryx*, may represent the same Brown County species.

Left ramus with symphysis and p_2 - m_3 . (w++) F:A.M.31190 1934.
This paper, *Fig. 45*.
Left fragment, p_4 - m_3 . (w+) F:A.M.31190A

(b) From J. Wilson Ranch (slightly larger than type, but smaller than F:A.M. 31190):

A single ramus, referred from this locality, exhibits tall, narrow-lobed molars, a long slender p_4 , and an m_3 with a well marked talonid. The postsymphysial distance was evidently long. (The distance from the p_2 alveolus to the broken tip measures 29 mm., and yet there is no sign of the anterior mental foramen or of the beginning of the symphysis.)

Partial left ramus with p_2 - p_3 alveoli and p_4 - m_3 . (M) F:A.M.31543 1933.
This paper, *Fig. 45*.

(c) From Q. Kat Quarry Channel:

Left ramus with diastema and m_1 - m_3 . (w+) F:A.M.33726 1936.

(d) From E. Kat Quarry Channel:

Left fragment with m_2 - m_3 (erupting). F:A.M.32196 1936.

(e) From *Leptarcus* Quarry Channel:

Left fragment with m_2 - m_3 . (M+) F:A.M.34035 1936.
Left immature ramus with diastema and dp_3 - m_2 . F:A.M.34036 1936.

(See Limb Section, page 516.)

(2a) *Plioceros dehlini*, new species

From Snake River, Cherry County, Nebraska

See discussion (page 473) of specimen, which includes the only so-far-known skull referred to the genus.

TYPE.—Skull lacking much of muzzle but exhibiting both premaxillæ, maxillary dentition, palate and all of cranium posterior to the anterior border of the orbits, including bullæ, etc.; mandible and dentition completely represented (excepting I_1 – I_2) ($M+$); and nearly complete representation of limb elements (see Limb Section, page 516, and *Fig. 25B*.)

F:A.M.32101 From S.E. $\frac{1}{4}$ Sec. 32, T.32, R.30, 1934. (Near, but stratigraphically 130 feet above, channel deposits of Meisner locality.)
This paper, *Fig. 26*.

Postsymphysial distance...	= 22.4 mm.	m_3	
p_2	= 4.2	Postsymphysial distance	= 67%
p_3	= 6.3	p_2	
p_4	= 8.3	p_4	= 51%
/ps series.....	= 18.6	/ps series	
m_3	= 15.	/ms series	= 55%
/ms series.....	= 33.6		

(2b-c) (?) *Plioceros* Vars.

Limb elements from a Nebraska and a Kansas locality are interpreted as representing a possible variation or variations of the genus *Plioceros*. (See Limb Section, page 517.)

(2b) From Hitchcock County, Nebraska

Note skeletal elements. A.M.8501 From Oak Canyon, 1880.

Possibly the same individual as represented by right ramal fragment with broken p_4 – m_3 (A.M.8501). [Tooth size approximating Leyden, New Mexico, specimen (F:A.M.31686).]

(2c) From Beaver Creek, Kansas¹

Note left metacarpus, etc. F:A.M.31513 1933.

This paper, *Fig. 48*.

¹From Clark County, Kansas
(Not included in specimen count)

Left fragment with m_3 and broken m_3 . (w)

F:A.M.30912

Etc. detached m_3 /.

F:A.M.30912A–E

(3) *Plioceros* species

From Harper, Malheur County, Oregon

Sphenophalos nevadanus MERRIAM, referred FURLONG, 1932, Carn. Inst. Wash. Pub. 418, p. 30, Pl. I, Figs. 1-8.

EXAMPLE.—Left horn-core. C.I.T.16 Figured by Furlong, 1932, Pl. I, Figs. 1-4.

REFERRED, LARGER-SIZED SPECIMEN.—

Right horn-core. C.I.T.17 Figured by Furlong, 1932, Pl. I, Figs. 5-8.

According to figure, posterior horn-tip = 135 mm. above supra-orbital border, versus 90 mm. in largest New Mexican specimen.

Specimens tall and, according to the figures, in the prominent production or bulging of the main anterior edge and constriction of the base, differ from the New Mexican and certain of the Thousand Creek specimens.

(3a) Smaller Var.

From Rome, Malheur County, Oregon

Sphenophalos nevadanus MERRIAM, referred FURLONG, 1932, Carn. Inst. Wash. Pub. 418, p. 31, Pl. II, Figs. 1-7.

EXAMPLE.—Right horn-core. C.I.T.396 Figured by Furlong, 1932, Pl. II, Figs. 1 and 2.

Smaller than preceding C.I.T.16. According to figure, posterior tip would have been 80 mm. above the superior border of the orbit, and thereby approximating the 90 mm. of the largest New Mexican specimen. Base narrowed.

Horn-core. C.I.T.395 Figured by Furlong, 1932, Pl. II, Figs. 3, 4 and 5.

Cranial fragment. C.I.T.399 Figured by Furlong, 1932, Pl. II, Figs. 6 and 7.

(4) *Plioceros* species and Vars. A and B

From Thousand Creek, Nevada

Tall, slight-waisted

Sphenophalos nevadanus MERRIAM, referred FURLONG, 1932, Carn. Inst. Wash. Pub. 418, Pl. III, Figs. 1-6. STIRTON, 1932, Amer. Journ. Sci. (5), XXIV, p. 46, Figs. 1-3.

EXAMPLE.—Two horn-cores. C.I.T. Coll. Figured by Furlong, 1932, Pl.
(Specimens, Figs. 4–6, a questioned form.) III, Figs. 1–6.

REFERRED.—

Partial pair of horn-cores and three ms/.	U.C.31525	From 1.1 mi. W. of Hot Spring, Thousand Creek beds, Humboldt County, Nevada, 1930. Figured by Stirton, 1932, Figs. 1–3.
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Var. A

(Specimens more fragmentary and possibly smaller than those of Furlong Plate III. Narrow-waisted as in Rome, Oregon, specimens.)

Sphenophalos nevadanus MERRIAM, referred MERRIAM, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 286, Figs. 67a and b. Referred FURLONG, 1932, Carn. Inst. Wash. Pub. 418, p. 32, Pl. iv, Figs. 1–4, 6; Pl. v, Fig. 4.

EXAMPLE.—Portion of horn- core.	U.C.22427	Figured by Furlong, 1932, Pl. iv, Figs. 1–4.
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REFERRED.—

Basal section of horn-core.	U.C.12537	Figured by Merriam, 1911, Figs. 67a and b.
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Horn-core of strongly "tied-in" appearance in both U.C.12537 and 22427.

Horn-core (fragmentary).	U.C.11888	Figured by Furlong, 1932, Pl. iv, Fig. 6; Pl. v, Fig. 4.
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(Note U.C.11887, figured by Furlong, 1932, Pl. iv, Fig. 8, is the genotype of *Sphenophalos*.)

Var. B

Sphenophalos nevadanus MERRIAM, referred MERRIAM AND STOCK, 1928, Carn. Inst. Wash. Pub. 393, p. 20, Figs. 13 and 14. Referred FURLONG, 1932, *ibid.*, Pub. 418, p. 33.

EXAMPLE.—Horn-core.	U.C.22429	Figured by Merriam and Stock, 1928, Fig. 13.
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REFERRED.—

Smaller and probably less
mature horn-core.

U.C.22430

Figured by Merriam and
Stock, 1928, Fig. 14.

The describers observe the smaller size, the dumbbell-like cross section and the outward deflection of the lower anterior fork of these horn-cores.

Furlong (1932, p. 35) notes that the fragmental horn-core tip from Thousand Creek beds mentioned under:

Neotragocerus improvisus MATTHEW AND COOK, ?ref. MERRIAM, 1909, Univ. Cal. Pub. Bull. Dept. Geol., V, p. 330, and

Tragoceras(?) or *Ilingoceros* MERRIAM, 1911, *ibid.*, VI, p. 303,

and which Merriam (1911) considers might represent the terminal portion of a large *Ilingoceros* horn, may now be regarded as the terminal portion of the posterior prong of *Sphenophalos*, i.e. as here interpreted, *Plioceros*

VII. *TEXOCEROS*, NEW GENUS

The *Texoceros* horn-core (Fig. 50), in the deep division of the base and elongation of the fork, is distinct from that of *Plioceros*, n.g., and more approaches the form of Pleistocene *Stockoceros*, n.subg. The base is considerably less deeply incised than in the latter. The figured horn-core from Guymon is the only *Texoceros* horn specimen definitely known. It is presumed that the Guymon or a closely allied species is represented by the rami and detached teeth from Miami Quarry, Texas. To the genus, as noted (p. 474), are very doubtfully referred the several species based on certain smaller teeth from Yuma County, Colorado, from Arizona and from Snake Creek, Nebraska. A fourth species of *Texoceros* possibly may be represented by the interesting partial horn-core, mandibular rami and detached teeth from the Uppermost Pliocene of Eden, California.

The collection from the Guymon-Optima deposits of Oklahoma includes the partial horn-core, ninety-three mandibular rami, or partial rami, fifteen maxillæ and many detached teeth and limb elements secured by the Charles Falkenbach 1934-35 field party. The great majority of the specimens exhibit only a moderate size variation (Fig. 52) and are interpreted, respectively, as of males and females of one species, *T. guymonensis*. A few noticeably larger specimens of somewhat different form may represent a second species. The latter are exemplified by a mandibular ramus, F:A.M.32147, which lacks trace of the p_2 and tends to be heavier-toothed and shorter-diastramaed than any other specimen in the series; by a number of detached m_3 s (Figs. 52, 52A); and by a notably heavier metapodial which is 18% longer than the short-

est of the Guymon specimens (see Limb Section, p. 517). A third and smaller Guymon form is questionably referred to the genus as a distinct species, (?) *T. minorei*.

The type specimens and remains referred to the seven above-listed *Texoceros* species from Oklahoma, Texas, Colorado, Arizona, Nebraska and California (see p. 483) are:

(1) *Texoceros guymonensis*, new genus and species

From Guymon, Texas County, Oklahoma, 1934

GENOTYPE.—Left horn-core with superior border of orbit, etc., anterior prong (broken) and tip of posterior prong missing..... *Fig. 50* H-D¹ F:A.M. 31675

REFERRED.—

(a) Teeth tending heavy and diastema short:

Right ramus with symphysis and p_2 - m_3 (no sign of p_2 alveolus).....	(w+) <i>Fig. 52</i>	H-D	32147
Left fragment with p_2 - p_3 alveoli and p_4 - m_3	(A)	H-C	32126
m_3 , left.....	(M)	H-C	32132
Three mature right and two left m_3 s.....	(M+)-(w+)	R, H,	32132A
	B only, <i>Fig. 52</i>	F-D	-E

(And see large maxilla, F:A.M.32150E, and metatarsus, F:A.M.32149.)

EIGHTY MANDIBULAR SPECIMENS

(b) Molars more moderate-sized, /ps slighter:

(Five specimens exhibit smaller-sized teeth than the average: F:A.M.32165, 32151, 32161D, 32162C and 32165B.)

Left ramus with symphysis and p_2 - m_3	(M+) <i>Fig. 52</i>	H-D	32121
Right ramus with symphysis, p_2 alveolus, p_3 - m_3	(M+)	R-D	32108
Left ramus with partial symphysis, p_2 alveolus and p_3 - m_3	(w+)	F-D	32130
Left ramus with symphysis and p_2 - m_3 (br.).....	(M+)	F-B	32154
Right ramus with symphysis and p_2 - m_3	(A) <i>Fig. 52</i>	F-C	32159
Right ramus with diastema and p_2 - m_3	(M+)	F-A	32162
Left ramus with symphysis and p_2 - m_3	(M+)	R-D	32122
Left ramus with p_2 - m_3	(w)	F-D	32165
Right ramus with symphysis and p_2 - m_3 (p_3 and m_1 br.).....	(w+)	F-B	32155

¹ LOCALITIES: F = Flats, H = Highway, R = Railroad or Railroad Cut.
HORIZONS: A = Top Sandy Clay, B = Clay, C = Sandy Clay, D = Sand.

			F.A.M.
Crushed mandible with p_2-m_3 (see page 506)....	(M+)	F-B	32151
Left ramus with symphysis and p_2-m_3	(W)	F-C	32161G
Partial right ramus with p_2 alveolus and p_3-m_3 ..	(M)	R-D	32111
Left fragment with p_2-m_3	(M)	F-B	32152
Left fragment with partial symphysis, p_2-m_2 ..	(A)	F-C	32161B
Partial left ramus with p_3-m_3	(M)	R-D	32109
Left ramus with symphysis, p_2 alveolus, p_3-m_3 ..	(M+)	"	32106
Partial right ramus with p_2 alveolus and p_3-m_3 ..	(M+)	"	32107
Partial left ramus with p_2 alveolus and p_3-m_3	(M+)	"	32113
Left ramus with symphysis, p_2 alveolus, p_3-m_3 ...	(W+)	"	32124
Partial right ramus with p_2 alveolus and p_3-m_3 ..	(W+)	"	32105
Right fragment with p_3 alveolus and p_4-m_3	(M+)	"	32112
Partial left ramus with roots of all premolars, and m_1-m_3	(W++)	"	32110
Partial left ramus with p_2-m_1 alveoli and m_2-m_3 .	(W)	"	32114
Partial left ramus with p_2 alveolus and p_3-m_1	(W+)	"	32127
Partial left ramus with alveoli of /Is and p_2-p_3 , and p_4-m_1	(W+)	"	32128
Right fragment with p_2 (br.)- m_3	(W+)	"	32166
Left ramus with p_2 alveolus and p_3-m_3 (m_2 br.)..	(M)	"	32166A
Anterior portion of ramus with diastema, p_2-m_1 .	(M)	"	32166B
Left fragment with p_2 alveolus and p_3-m_2	(W)	"	32115
Right fragment with p_2-m_2	(W)	"	32116
Left fragment with m_1-m_3	(M)	"	32129
m_3 , left (representing smallest size).....	(M)	"	32133
Right fragment with p_2 alveolus and p_2-m_3	(W)	F-B	32153
Left fragment with p_3 (br.)- m_3	(W)	"	32156
Right fragment with p_2 alveolus, p_3 and m_1-m_3 ...	(W+)	"	32158
Left fragment with broken p_4-m_2 , and m_3	(M+)	"	32158A
Right fragment with m_1-m_3	(M+)	"	32158B
Left fragment with p_3-m_3	(W)	"	32158D
Right ramus with symphysis, fragments of p_2 and p_4 , m_2-m_3	(W++)	"	32158E
Left fragment with distorted symphysis, /Is and p_3 (br.)- m_2 (br.).....	(W)	"	32158F
Right fragment with p_2-m_3 (m_2 and m_3 crushed).	(W)	"	32158G
Right ramus with p_3-m_3 (crushed).....	(W+)	"	32158H
Right fragment with crushed dentition.....		"	32158I
Right fragment with p_4-m_3	(M+)	"	32158J
Left fragment with p_3-m_3	(W)	"	32158K
Right fragment with p_3-m_3 (teeth broken).....	(M+)	"	32158L
Left crushed ramus with symphysis and p_2-m_3 ..	(W+)	"	32158M

			F:A.M.
Right ramus with p_3-m_3	(A)	F-C	32160
Right fragment with p_4-m_3	(w)	"	32161A
Left fragment with partial symphysis, p_2 alveolus and p_3-m_2	(w)	"	32161C
Left fragment, symphysis, p_2 alveolus, p_3-m_3 ..	(M+)	"	32161D
Left fragment with m_1-m_3	(M)	"	32161E
Right fragment with $p_4(br.)-m_2$	(w)	"	32161F
Left fragment with broken teeth.....		"	32161I
Right fragment with p_2-m_2	(M+)	"	32162A
Right fragment with symphysis and p_3-m_3	(w++)	"	32162B
Left fragment with partial symphysis, p_2 alveolus and p_4-m_2	(w)	"	32162C
Left fragment with symphysis, p_2 alveolus, p_3-m_3 ..	(w)	"	32162D
Left ramus with partial symphysis, p_2-p_3 alveoli and p_4-m_3	(w)	F-D	32163
Right ramus with symphysis, p_2 alveolus, p_3-m_3 ..	(w)	"	32164
Left ramus with partial symphysis, $p_2(br.)-m_3$..	(w++)	"	32164A
Right fragment with partial symphysis, p_2 alveolus and p_3-m_1	(A)	"	32164B
Left fragment with p_2-m_2	(M+)	"	32164C
Right ramus with partial symphysis, p_2 alveolus and p_3-m_3	(w)	"	32165A
Left fragment with partial symphysis, p_2-m_1 and m_3	(w)	"	32165B
Right fragment with partial symphysis, p_2 alveolus and p_3-m_2	(w)	"	32165C
Right fragment with partial symphysis, p_2 alveolus, p_3 root and p_4-m_2	(w)	"	32165D
Left fragment with partial symphysis, p_2 alveolus, p_3 root and p_4-m_3	(w+)	"	32165E
Left fragment with p_3-m_2	(w+)	"	32131
Left crushed ramus with symphysis, $p_3-m_3(br.)$..		"	32148
Left fragment with p_2 alveolus and p_3-m_3	(w+)	"	32165F
Right fragment with p_3-m_1 (crushed).....		"	32165G
Left fragment with p_3-m_3	(w+)	R-C	32167
Left fragment with p_3 alveolus and p_4-m_3	(M+)	"	32167A
Right fragment with $p_4, m_1(br.)-m_3$	(M+)	"	32167B
Right fragment with p_3 alveolus and p_4-m_3	(w)	"	32125
Left fragment with diastema and p_3-m_1	(w)	H-B	32126A
Right ramus with symphysis, p_2 alveolus, p_3-m_3 ..	(w)	H-D	31666
Left ramus with symphysis, p_2 alveolus, p_3-m_3 ..	(A)	"	31667
Right ramus with partial symphysis, p_2 alveolus and p_3-m_3	(M+)	"	32123
Numerous incisors.			

THIRTEEN MAXILLARY DENTITIONS			F:A.M.
Left fragment with p^3-m^3 (m^2 br.).....	(w)	F-B	32150
Right fragment with p^3-m^3	(w+)	"	32150A
Right fragment with p^3-m^3	(w++)	"	32150B
Right fragment with p^4-m^3	(M+)	"	32150C
Left fragment with m^2-m^3	(w)	"	32150G
Right fragment with p^3-m^3 (p^3-m^1 br.).....	(M+)	F-C	32150D
Left maxilla with p^3-m^3	(M)	R-C	32138
<i>Fig. 52A</i>			
Right fragment with p^4-m^3	(M+)	"	32139
Right fragment with m^1-m^3	(M+)	"	32140
Right fragment with m^1-m^3	(M)	"	32141
Left maxilla with p^2-m^3	(M+)	H-D	32137
Left fragment with m^2-m^3	(M+)	Area	32150F
Right fragment with m^2-m^3 (larger).....	(w+)	"	32150E

IMMATURE DENTITIONS

ELEVEN RAMI

Right ramus with dp_2-m_1		R-D	32144
Partial mandible with dp_2-m_1 (br.) represented..	<i>Fig. 52</i>	F-C	31665
Right fragment with p_2-p_3 , dp_4-m_3		"	32161
Left fragment with crushed symphysis, /Is, p_3 , dp_4 , m_1-m_2		"	32161H
Right fragment with dp_2-dp_3 roots, dp_4-m_1 (erupting).....		"	31663
Left fragment with dp_4-m_1		Area	31663A
Right fragment with dp_2-m_1 (br.)		F-B	31664
Left fragment with alveoli and dp_4-m_3		"	32158C
Left ramus with partial symphysis and dp_4-m_3 ..		"	32157
Left fragment with dp_2-m_1 (erupting).....		F-D	31664A
Left ramus with dp_4 , m_1-m_2 , p_2-p_4 in germ.....		H-C	32146

TWO MAXILLÆ

Fragment with dp^3-dp^4 , m^2 (br.) and m^3 (br.).....	F-D	31661
Left fragment with dp^2 alveolus and dp^3-m^1	"	31662

And many unlisted ramal and maxillary fragments, and detached lower and upper teeth, from the same general area. Largest and smallest m_3^3 s are exemplified respectively by: m^3 s, F:A.M.32132G and H (this paper, *Fig. 52A*); and m_3 s, F:A.M. 32132B and F (this paper, *Fig. 52*).

(See referred limb elements, Limb Section, page 517.)

(1a) *Texoceros texanus* (Hesse)

From Hemphill County, Texas

Merycodus sp. nov. MATTHEW, REED AND LONGNECKER, 1932, Univ. Texas Bull. No. 3231, p. 65.

Capromeryx texanus HESSE, 1935, Journ. Mamm., XVI, No. 4, p. 311, Figs. 4, 5 (in part).

TYPE.—Left ramus with incisive alveoli and p_1 - m_3 . (w++)

U.C.30337

From N. W. Hemphill County, Texas.

Figured by Hesse, 1935, Figs. 4, 5 (in part).

The teeth as figured are smaller than most of the following remains and seemingly even smaller than the smallest of the *T. guymonensis* specimens.

REFERRED FROM MIAMI QUARRY.—

MODERATE-SIZED

Partial left ramus with p_4 - m_3 . (M++)

F:A.M.31651 1933.

Left fragment, p_3 - m_2 . (w)

F:A.M.31651A 1933.

Partial left ramus with m_1 - m_2 and germs of p_2 and p_4 .

Col.M.1335

Etc. detached teeth (1932-33):

m^3 . Col.M.1335A

m^2 . F:A.M.31652

m^1 . Col.M.1335

m_3 . F:A.M.31653

m_1 . F:A.M.31654

Etc. detached teeth of smaller size (1933):

m^2 . F:A.M.31655

m^1 . F:A.M.31656

m^1 . F:A.M.31657

m_3 . F:A.M.31658

m_2 . F:A.M.31659

m_1 . F:A.M.31660

"Merycodontinae, gen. nov.," listed by Matthew and Stirton (1930, Univ. Cal. Pub. Bull. Dept. Geol. Sci., XIX, p. 172), is probably the equivalent of the above.

As noted above, the five following species possibly lie nearer to *Plioceros* than to *Texoceros*.

(1b) (?) *Texoceros minorei*, new species

From Guymon, Oklahoma

Teeth are smaller than any of the other remains of the present section. Molar crowns tall and extremely slender.

TYPE.—Left fragment with p_2 - m_3 . (M+) F:A.M.31668 From H-C, 1934.
This paper, Fig. 52.

Compared to small *T. guymonensis*, F:A.M.32151:

	F:A.M. 31668	F:A.M. 32151		F:A.M. 31668	F:A.M. 32151
p_2	5.2 mm.	6.1 mm.	m_1	8.6 mm.	8.9 mm.
p_3	6.4	7.6	m_2	9.1	11.3
p_4	7.4	8.1	p_2 - m_3	36.	40.

(2) (?) *Texoceros vughani*, new species

From Wray, Yuma County, Colorado

Portions of mandibular rami and teeth from this area indicate a longer diastema, larger-proportioned p_2 and relatively smaller last lobe and vein of m_3 than common in the Guymon *Texoceros*, and might be referred to *Plioceros*. (The Wray specimens exhibit a certain size variation.)

TYPE.—Mandibular symphysis with p_2 - p_3 alveoli and p_4 - m_2 . (M+) F:A.M.31312A Collected by N. J. Vaughan, 1935.
This paper, Fig. 52.
(Long diastema and very small teeth.)

REFERRED (larger than type).—

Right ramus with p_2 - m_3 . (M)	F:A.M.31312	1934. This paper, Fig. 52.
Left ramus with partial diastema, p_2 - p_3 alveoli and p_4 (br.)- m_3 . (W) (Not included in specimen count.)	F:A.M.31645	1936.
Left fragment with p_3 - m_1 and alveoli of p_2 , m_2 - m_3 .	Col.M.222	
Right and left m_3 s.	F:A.M.31313, A	
Left maxilla with m^1 - m^2 .	F:A.M.31314	
Detached p^2 - p^4 .	F:A.M.31315, A	
Etc. detached m s/ and p s/.		

- | | | |
|--|-------------|------------------------------|
| Astragalus. | F:A.M.31648 | From Section 8. |
| Right metatarsus. | Col.M.219 | This paper, <i>Fig. 48</i> . |
| (Larger and probably distinct species, approximating Guymon F:A.M. 32149.) | | |
| (See Limb Section, page 518.) | | |

(3) (?) *Texoceros* species

From Benson, Arizona

A few teeth from Benson, Arizona, would seem to represent a small member of this group rather than a *Merycodontine* species.

- | | | |
|--|-------------|-------|
| EXAMPLE.—Right p^3 - m^3 , detached. | F:A.M.32060 | 1929. |
| Left m^3 . | F:A.M.32061 | 1929. |
| $m/$, broken. | F:A.M.32062 | 1929. |

(4) (?) *Texoceros altidens* (Matthew)

From "Upper Snake Creek," Sioux County, Nebraska

(The teeth are shorter-crowned than those from Oklahoma, and may be referred only tentatively to the genus.)

- ? *Merycodus altidens* MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 200, Fig. 60.
Capromeryx altidens (MATTHEW), HESSE, 1935, Journ. Mamm., XVI, No. 4, p. 308.

- | | | |
|---|-----------|--|
| TYPE.—Right fragment of ramus with worn m_3 . | A.M.18981 | From Upper Snake Creek.
Figured by Matthew, 1924,
Fig. 60. |
|---|-----------|--|

"PARATYPES" (from type horizon).—

- | | | |
|---------|------------|---------------------------------------|
| m^3 . | A.M.18981a | |
| m_3 . | A.M.18981b | Figured by Matthew, 1924,
Fig. 60. |

REFERRED.—

- | | | |
|---|-------------|--|
| Left fragment with p_4 - m_3 .
(w) | F:A.M.33749 | From <i>Hipparion affine</i> Zone,
<i>Merychippus</i> Draw, 1936. |
| Detached m^1 and detached m^3 . | A.M.21475 | From S. of <i>Pliohippus</i> Draw,
1925. |

Three detached m _s . (M+, w)	A.M.18981	From Quarry No. 1.
Detached m _s . (w++) (Third lobe noticeably much enlarged versus above.)	A.M.21475	S. of <i>Pliohippus</i> Draw, 1925.
Detached right m _s . (w) Smaller.	A.M.18981c	
Right metatarsus. (See Limb Section, page 518).	A.M.22473	Quarry B, Snake Creek, 1921. This paper, <i>Fig. 18</i> .

(5) (?) *Texoceros edensis*, new species

From Uppermost Pliocene, Eden, California

Antilocapra?, n.sp. FRICK, 1921, Univ. Cal. Pub. Bull. Dept. Geol., XII, p. 380, Text-Figs. 101, 102.

Under "*Antilocapra?*, n.sp." the writer (1921) described and figured several detached upper and lower molars and a horn-core from the Eden beds. The slightly smaller dimensions but marked general similarity of the teeth to those of the living form were observed. The horn, as then drawn (Text-Fig. 101), is very suggestive of a modified *Stockoceros* core.

Among the collections from the same Uppermost Pliocene deposit subsequently secured by the late Joseph Rak, are a considerable number of partial rami and detached teeth not definitely distinguishable from those previously described. The teeth are exceptional for their long crowns and lateral compression. In the elongation of the anterior ramus and of the crowns of the posterior molars, and in the transverse narrowness of the teeth, the specimens differ from the equally large though heavier rami from Oklahoma. The type ramus and teeth are notably more slender than in *Hayoceros*. Larger and smaller size variations are present.

TYPE.—Left ramus with sym- physis, p ₂ -p ₃ alveoli and p ₄ -m ₃ (br.). (M+)	F:A.M.31765	This paper, <i>Fig. 52B</i> .
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REFERRED SLIGHTLY LARGER-SIZED PARTIAL DENTITIONS AND DETACHED TEETH FROM TYPE LOCALITY.—

MEDIUM-SIZED

Right fragment with all /ps alveoli and m ₁ -m ₃ .	F:A.M.31750	This paper, <i>Fig. 52B</i> .
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Left fragment with m_1 (br.)- m_3 .	F:A.M.31752
Right fragment with m_1 (br.)- m_3 (br.).	F:A.M.31753
Left fragment with m_2 - m_3 .	F:A.M.31754

Nine detached teeth:

Right m^2 .	F:A.M.31755	
Left m^2 .	F:A.M.31756	
Right m^2 .	F:A.M.31757	
Left m_3 .	F:A.M.31758	This paper, <i>Fig. 52B</i> .
Left m_3 .	F:A.M.31759	This paper, <i>Fig. 52B</i> .
Left m_3 (br.).	F:A.M.31760	
Right m_3 .	F:A.M.31761	
Left m_3 (br.), unworn.	F:A.M.31762	This paper, <i>Fig. 52B</i> .
Left m_2 .	F:A.M.31763	This paper, <i>Fig. 52B</i> .

Three detached teeth, small, type-sized:

m_1 .	F:A.M.31766	
m_1 .	F:A.M.31767	
m_3 .	F:A.M.31768	This paper, <i>Fig. 52B</i> .

Two Eden specimens figured (1921) under *Antilocapra?*, collected by Joseph Rak:

Partial forked horn-core.	U.C.23421	Figured by Frick, 1921, Text- Fig. 101.
Partial carpus.	U.C.23432	Figured by Frick, 1921, Text- Figs. 102a, b.

(5a) Var. A

(Smaller. Anterior ramus abruptly narrowing and premolars reduced.)

EXAMPLE.—Right fragment with p_3 (br.)- m_2 and de- tached m_3 . (w++)	F:A.M.31770	This paper, <i>Fig. 52B</i> .
Left fragment with (?) broken p_2 - p_3 . (M)	F:A.M.31771	
Left fragment, p_4 - m_2 . (w+)	F:A.M.31751	
Left maxilla, (?) dp^4 - m^2 .	F:A.M.31769	

VIII. PROANTILOCAPRA BARBOUR AND SCHULTZ

Reconstruction, Fig. 49B

Known so far alone in the genotypic species from Cherry County, Nebraska (see discussion, page 474).

(1) *Proantilocapra platycornea* Barbour and Schultz

From Cherry County, Nebraska

Proantilocapra platycornea BARBOUR AND SCHULTZ, 1934, Amer. Mus. Novitates, No. 734, p. 3, Fig. 1 (in part).

GENOTYPE.—Partial skull with left maxilla, p^2 alveolus, p^2 - m^2 in place; left horn-core attached to a piece of the frontal, portion of occipital area; two rami with partial diastema, p_2 alveolus, p_2 - m_2 in place; and unusually well represented skeletal elements (see Limb Section, page 519). (M+)

Ant. p_2 - m_2 = 44.5 mm.

(For measurements, see Barbour and Schultz, 1934, p. 1.)

N.S.M.2-5-8-30

From the Lower Pliocene, 40 feet below top of the exposed Tertiary, approx. one mile below mouth of Steer Creek, on E. side of Snake River, Cherry County, Nebraska.

Collected August 5, 1930.

Figured by Barbour and Schultz, 1934, Fig. 1 (in part); this paper, *Figs. 48* (limbs), *50* (partial skull and ramus).

TABLE XI
ANTILOCAPRINI COMPARATIVE LIMB MEASUREMENTS AND RATIOS

	Collection No.	Limb Size Group	Humerus		Radius		Metacarpus		Femur		Tibia		Metatarsus		Humerus/Radius		Metacarpus/Radius		Femur/Tibia		Metatarsus/Tibia		Metacarpus/Metatarsus		Radius/Tibia		See Figure
			mm.		mm.		mm.		mm.		mm.		mm.		%		%		%		%		%		%		
LATE TERTIARY:																											
<i>Ilingoceros schizoceros</i> , ref., Thousand Cr., Nev.	U.C.19419	I+																									
<i>Osbornoceros osborni</i> , ref., Round Mt., N. Mex.	Unassoc., p. 514	II+			147						193		(190)												76		
<i>Plioceros blicki</i> , ref., Santa Clara, N. Mex.	F.A.M.31694	I											157														
(?) <i>P.</i> var., Beaver Cr., Kans.	F.A.M.31513	I-					140						(172)														
<i>P. delini</i> , type (♀), Cherry Co., Nebr.	F.A.M.32101	III			129		125		140		172		140				97		81				89		75		48
<i>Proantilocapra platycornea</i> , genotype, Cherry Co., Nebr.	N.S.M.2-5-8-30	III-	107		119		116				168		132				97						88		70		48
(?) <i>Tetoceros altidens</i> , ref., Sioux Co., Nebr.	A.M.22473	I											179														18
(?) <i>T. vaughani</i> , ref., Yuma Co., Colo.	Col.M.219	"											172														48
<i>T. guymonensis</i> , ref., Texas Co., Okla.	Unassoc., p. 517	I, II			151-136		147-140						175-148														

(See Pleistocene measurements on following page.)

TABLE XI—Continued

Collection No.	Limb Size Group	Humerus	Radius	Metacarpus	Femur	Tibia	Metatarsus	Humerus/Radius		Metacarpus/Radius		Femur/Tibia		Metatarsus/Tibia		% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% Metatarsus/	% Radius/Tibia	% 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() approximate.

Limb Elements Representing the Above Late Tertiary Antilocapri Genera and Species

Figures (in part) 18, 25B, 48

(For skulls, horn-cores and dentitions, see preceding section.)

Certain long and slender metapodials of this section approximate Size Group I of the Blastomerycine series. The one so far represented metapodial of *Ilingoceros* is of a larger size group, 1+. Size Group I to I- include metapodials of *Plioceros* from New Mexico and from Hitchcock County, Nebraska. The largest limbs grouped under *Texoceros guy-monensis*, which, as noted below, are only tentatively referred and may represent a distinct species, approximate Size Group I, while the smaller and more commonly represented elements of the species are of Size Group II. The female *Plioceros dehlini* and the *Proantilocapra platycornea* skeletons, from Cherry County, fall in Size Group III to III-, and the New Mexican *Osbornoceros* in Size Group II to II+.

Some ten of the species and variants seem to be represented by limb elements; where the association is definite, the species are starred.

(Compare species summary, page 481; and see measurement table, page 511. Numbers in parentheses refer to species in the preceding discussion of dentitions. Compare Pleistocene limb elements, page 535.)

GENERA AND SPECIES RELISTED

IV. *Osbornoceros*, NEW GENUS

LIMB SIZE GROUPS II AND II+.

- *(1) *O. osborni*, n.sp., referred, from New Mexico.

V. *Ilingoceros* MERRIAM

LIMB SIZE GROUP I+.

- (1a) *I. schizoceras* Merriam, referred, from Thousand Creek beds, Nevada.
Species (1) is not represented by limbs.

VA. *Sphenophalos* MERRIAM

Not represented by limbs.

VI. *Plioceros*, NEW GENUS

LIMB SIZE GROUPS I TO III.

- (1) *P. blicki*, n.sp., referred, from New Mexico.

LIMB SIZE GROUP II.

- (2) *P. foblaini*, n.sp., referred, from Brown and Cherry Counties, Nebraska.

LIMB SIZE GROUP III.

- *(2a) *P. dehlini*, n.sp., ♀, from Snake River, Cherry County, Nebraska. This paper, *Fig. 25B* (F:A.M.32101).

LIMB SIZE GROUP I-.

- (2b-2c) (?) *P.* var. or vars., represented only in skeletal elements from:
 (2b) Hitchcock County, Nebraska
 (2c) Kansas
 Species (3), (3a) and (4) are not represented by limbs.

VII. *Texoceros*, NEW GENUS

LIMB SIZE GROUPS I AND II.

- (1) *T. guymonensis*, n.sp., referred, from Guymon, Texas County, Oklahoma. This paper, *Fig. 48* (F:A.M.31671 and 31672).

LIMB SIZE GROUP I.

- (2) (?) *T. vaughani*, n.sp., very doubtfully referred, from Yuma County, Colorado. This paper, *Fig. 48* (Col.M.219).
 (4) (?) *T. alidens* (Matthew), referred, from Sioux County, Nebraska. This paper, *Fig. 18* (A.M.22473).
 Species (1a), (1b), (3), (5) and (5a) are not represented by limbs.

VIII. *Proantilocapra* BARBOUR AND SCHULTZ

LIMB SIZE GROUP III-.

- *(1) *P. platycornea* Barbour and Schultz, from Cherry County, Nebraska. This paper, *Fig. 48* (N.S.M.2-5-8-30).

DETAILED LISTS OF LIMB ELEMENTS OF THE ABOVE GENERA AND SPECIES

IV. *Osbornoceros*, NEW GENUS

LIMB SIZE GROUPS II AND II+.

- (1) *O. osborni*, n.sp., referred

From Santa Fé Area, New Mexico

(Metatarsi approximating average specimens from Guymon, Oklahoma, and slightly larger than largest Merycodonts from New Mexico.)

REFERRED FROM LEYDEN QUARRY, 1935.—

	F:A.M.
Right radius, 147 mm.....	32998
Right tibia, 193 mm.....	32991

	F:A.M.
Right, 157 mm., and left metatarsi.....	32992,A
Partial left calcaneum, left astragalus and tarsal bone.....	32992B
Three 1st and two 2d phalanges, F:A.M. Coll.	
Two unguals (unusually compressed laterally), F:A.M. Coll.	

TENTATIVELY REFERRED FROM SAN JUAN, 1935 (metatarsi slightly shorter and noticeably narrower-proportioned, dorsoventrally, than in the above)—possibly of *Plioceros*.—

Distal one-half right humerus and articulated radius. (See associated maxilla, page 491.).....	32989
Distal two-thirds left humerus and ulno-radius (probably associated).....	32989A
Distal halves of right and left tibiæ.....	32993,A
Right and left metatarsi.....	32994,A

Immature specimens:

Distal two-thirds right humerus, right radius with proximal portion of ulna (articulated), left humeral trochlea, left radius (distal epiphysis missing), right metacarpus and calcaneum.....	32995
One 1st, two 2d and two 3d phalanges, F:A.M. Coll.	
Several vertebræ and fragments of limbs, F:A.M. Coll.	

V. *Ilingoceros* MERRIAM

LIMB SIZE GROUP I+.

- (1a) *I. schizoceras* Merriam, referred
From Thousand Creek Beds, Nevada

Right metatarsus, (190) mm.	U.C.19419	Figured by Merriam, 1911, Fig. 74.
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VI. *Plioceros*, NEW GENUS

LIMB SIZE GROUPS I AND III.

- (1) *P. blicki*, n.sp., referred
From New Mexico

S.G. I.

Distal end right tibia, right tarsus and nearly complete right metatarsus.	F:A.M.31694	From Santa Clara, 1930.
Distal one-fourth left tibia.	F:A.M.31732	From Santa Fé, 1928.

S.G. III.

QUESTIONABLY REFERRED (possibly distinct, approximating size of *P. dehlini*).—

Right metacarpus.	F:A.M.31709	First ridge, Taos road, 1927.
Left metatarsus (proximal end broken).	F:A.M.31710	From above San Juan, 1928.

LIMB SIZE GROUP II.

(2) *P. floblairi*, n.sp., referred

From Brown and Cherry Counties, Nebraska

QUESTIONABLY REFERRED (from Xmas Quarry level).—

Distal one-fourth right humerus.	F:A.M.31933	From Dutch Creek, 1929.
Left radius, 139 mm.	F:A.M.31934	Kat Quarry channel, 1933.
Right metacarpus, 132 mm.	F:A.M.31935	From Deep Creek, 1930.
Distal one-half right tibia.	F:A.M.31936	Kat Quarry channel, 1931.
Left metatarsus, 144.5 mm.	F:A.M.32197	E. Kat Quarry channel, 1936.
Proximal one-third left metatarsus.	F:A.M.31943B	From J. Wilson Ranch, 1933.
Proximal two-thirds left metatarsus.	F:A.M.31943D	From Hans Johnson's Quarry, 1931.
Astragalus.	F:A.M.31936A	From an indefinite locality.

Larger, possibly male or distinct species not included in specimen count):

Left metacarpus, 158 mm.	F:A.M.34044	<i>Machærodus</i> Quarry, 1936.
Right femur.	F:A.M.34046	Kat Quarry channel, 1936.
Left metatarsus, 162.5 mm.	F:A.M.34045	<i>Leptarctus</i> Quarry, 1936.

LIMB SIZE GROUP III.

(2a) *P. dehlini*, n.sp. (♀)

From Snake River, Cherry County, Nebraska

TYPE (in part).—Distal one-half both humeri, left radius and ulna, greater portion of right ulna, one carpal, both metacarpi, three 1st, one 2d and two 3d phalanges, three cervical, ten dorsal, six lumbar and three caudal vertebræ, twenty-one complete and partial ribs, right ilium, right femur, right and nearly complete left tibiae, both calcanea, left astragalus, two left tarsals, both metatarsi, four 1st, four 2d and three 3d phalanges, etc. fragments.	F:A.M.32101	From S.E. $\frac{1}{4}$ Sec. 32, T. 32, R. 30, 1934. (Near, but stratigraphically 130 feet above, channel deposits of Meisner locality.)
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This paper, *Fig. 25B* (partial manus and pes).(See associated skull and mandible, page 497. This paper, *Fig. 26*.)
(For measurements, see Table XI, page 511.)

QUESTIONABLY REFERRED, LIMB SIZE GROUP III (from Xmas Quarry level, Brown, Keya Paha and Cherry Counties, Nebraska).—

Left and distal one-fourth right radius, proximal portion left ulna, right metacarpus, calcaneum and metatarsus, two 1st phalanges and one patella.	F:A.M.31942	From Murphy's Gulch, 1933. This paper, <i>Fig. 48</i> (right metacarpus and metatarsus).
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Distal one-third right humerus.	F:A.M.31943	From an indefinite locality, 1927.
Portions of right femur, both patellæ, both tibiæ nearly complete, both calcanea, astragali, three left tarsals, both metatarsi, two 1st, one 2d, three 3d phalanges, etc. fragments.	F:A.M.31957	From 1 mile E. of Garner Bridge, 1934.
Distal one-fourth right tibia. (Questioned.)	F:A.M.31943A	From an indefinite locality, 1927.
Astragalus.	F:A.M.31943C	From Moore Creek, 1931.
Astragalus.	F:A.M.31936D	From Lessig Ranch.
Astragalus.	F:A.M.31936B	From an indefinite locality.

LIMB SIZE GROUP I—.

(2b) (?)*P.* Var.

From Hitchcock County, Nebraska

EXAMPLE.—Distal one-fourth left tibia, astragalus, one tarsal and proximal one-fourth metatarsus.	A.M.8501	From Oak Canyon, 1880.
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(2c) (?)*P.* Var.

From Kansas

EXAMPLE.—Left metacarpus, proximal one-third right metatarsus, astragalus, one 2d and one 3d phalanx.	F:A.M.31513	From Beaver Creek, 1933. This paper, <i>Fig. 48</i> (left metacarpus).
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[It is possible that the same form may be represented by partial mandibular and maxillary dentitions and a metatarsus from Kansas, figured by C. J. Hesse under *Capromeryx altidens* (Matthew), referred (Journ. Mamm., 1935, XVI, No. 4, p. 309, Figs. 1, 2 and 3 [in part]).]

VII. *Texoceros*, NEW GENUS

LIMB SIZE GROUPS I AND II.

(1) *T. guymonensis*, n.sp., referred

From Guymon, Texas County, Oklahoma, 1934

Limb elements are not as plentifully represented as the rami; (a complete humerus, femur and tibia are so far wanting). A large size variation is noticed in a tentatively referred metatarsus, F:A.M.32149, which is 18% longer than the shortest specimen, F:A.M.32143D (see measurement table, page 511). This may represent a distinct species.

S.G. II.

Right radius.	F:A.M.32120	From R-D. ¹
Left radius, 136 mm.	F:A.M.32120A	From F-D.

¹ For abbreviations see footnote, page 501.

Right metacarpus, 147 mm.	F:A.M.32118	From R-D.
Right metacarpus.	F:A.M.32118A	From F-B.
Left metacarpus.	F:A.M.31671	From R-D. This paper, <i>Fig. 48.</i>
Right metacarpus, 140 mm.	F:A.M.32118B	From F-B.
Right metacarpus (epiphysis missing).	F:A.M.32118C	From F-D.
Partial right tibia.	F:A.M.32119D	From F-C.
Right metatarsus.	F:A.M.32143	From R-D.
Right metatarsus.	F:A.M.31672	From R-D. This paper, <i>Fig. 48.</i>
Right metatarsus.	F:A.M.32143A	From R-D.
Right metatarsus.	F:A.M.32119A	From R-D.
Right metatarsus.	F:A.M.32119	From R-D.
Left metatarsus, 148 mm.	F:A.M.32143D	From F-D.
Right metatarsus (epiphysis missing).	F:A.M.32143C	From F-C.

IMMATURE

Nearly complete associated right radius, metacarpus and 1st phalanx.	F:A.M.32102	From F-B.
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S.G. I.

Left radius, proximal end crushed, (151) mm.	F:A.M.32103	From F-C.
Right metatarsus, 175 mm.	F:A.M.32149	From H-C.
Left metatarsus.	F:A.M.32142	From H-D.

LIMB SIZE GROUP I.

(2) (?) *T. vaughani*, n.sp., very doubtfully referred

From Wray, Yuma County, Colorado

Right metatarsus, 172 mm.	Col.M.219	This paper, <i>Fig. 48.</i>
(Large and probably distinct species, approximating Guymon F:A.M.32149.)		
Distal end of metapodial.	F:A.M.31316A	
Astragalus.	F:A.M.31316	

From Northeastern Colorado:

Astragalus.	F:A.M.31648	From Section 8.
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(4) (?) *T. altidens* (Matthew), referred

From Sioux County, Nebraska

Right metatarsus, 179 mm.	A.M.22473	Quarry B, Snake Creek, 1921. This paper, <i>Fig. 18.</i>
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VIII. *Proantilocapra* BARBOUR AND SCHULTZ

LIMB SIZE GROUP III-.

(1) *P. platycornea* Barbour and Schultz

From Cherry County, Nebraska

GENOTYPE (in part).—	N.S.M.2-5-8-30	From the Lower Pliocene, 40 feet below top of the exposed Tertiary, approx. one mile below mouth of Steer Creek, on E. side of Snake River.
Left humerus = 107 mm.		
Left radius = 119		
Left metacarpus = 116		
Distal half left femur		
Left tibia = 168		
Right metatarsus = 132		This paper, <i>Fig. 48</i> (metacarpus and metatarsus).
Miscellaneous ribs and vertebræ.		

(See associated partial skull and mandible, page 510. This paper, *Fig. 50*.)FIG. 53. *Antilocapri* horn-cores from the Pleistocene.× $\frac{1}{2}$. A¹, A², cross sections of horns; F, postorbital foramen; 2, supra-orbital foramen.F:A.M.25526, *Hayoceros falkenbachii*, n.subg. and sp., subgenotype, from Hay Springs, Sheridan County, Nebraska.

(See page 533.)

F:A.M.25687 and 25688, *Capromeryx fuscifer* Matthew, ref., from Hay Springs, Sheridan County, Nebraska.

(See page 528.)

L.A.M.174 (cast), *Stockoceros conklingi* (Stock), subgenotype, from Shelter Cave, New Mexico. (After Stock, 1930.)

(See page 526.)

A.M.13220 (S.M.U.1.50, cast), *Tetrameryx shuleri* Lull, genotype, from Dallas, Texas.

(See page 531.)

A.M.22489, *Stockoceros onusrosagris* (Roosevelt and Burden), ref., rev., from southern Arizona.

(See page 527.)

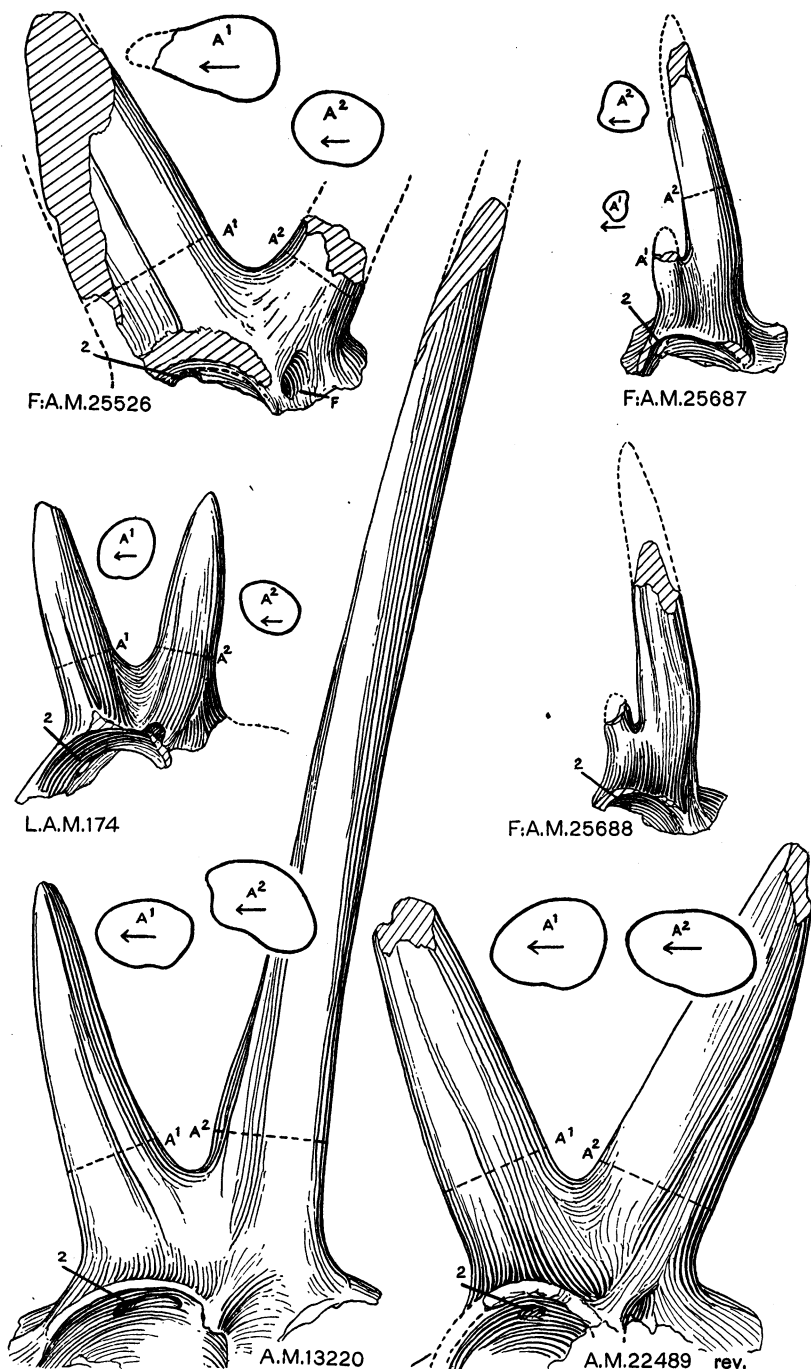


FIG. 53. *Hayoceros*, n.subg. (F:A.M.25526), *Capromeryx* Matthew (F:A.M. 25687, 25688), *Stockoceros*, n.subg. (L.A.M.174, cast, and A.M.22489) and *Tetrameryx* Lull [A.M.13220, cast (S.M.U.1.50)], comparison of horn-cores from the Pleistocene.

× ½. (See legend, page 519.)

(B) PLEISTOCENE SECTION, ANTILOCAPRINI

[See (A) Late Tertiary Section, page 469.]

Subfamily 5.—*Stockocerotinæ* (cont.)IX. *STOCKOCEROS*, NEW SUBGENUSX. *CAPROMERYX* MATTHEWXI. *TETRAMERYX* LULLXII. *HAYOCEROS*, NEW SUBGENUSSubfamily 6.—*Antilocaprinæ* ProperXIII. *ANTILOCAPRA* ORD

Figures 49A, AA, D, 53, 54 and (in part) 52A

Statement

Pleistocene genera of the Antilocaprid subfamilies, *Stockocerotinæ* and *Antilocaprinæ*, are considered as represented by single allied forms in the immediately preceding epoch—*Texoceros*, new genus, evidencing *Stockoceros*, new subgenus, and the small *Proantilocapra* suggesting *Antilocapra*. The balance of the known Pleistocene genera differ rather markedly in horn-cores from the so-far-known forms of the Tertiary, though they closely parallel one another and the latter in their slender tall-crowned cheek teeth. Five¹ genera and subgenera are recognized: IX, *Stockoceros*, new subgenus; X, *Capromeryx* Matthew; XI, *Tetrameryx* Lull; XII, *Hayoceros*, new subgenus; and XIII, *Antilocapra* Ord, referred. The nearest approach to actual resemblance between Quaternary and Tertiary horn-cores is that of *Stockoceros* and the Pliocene *Texoceros*. [The *Meryceros* horn, with its much deeper depression between the cylindrical terminal forks, its relative slenderness and its typical burred base is definitely distinct.] It is presumed that the variable horn-cores of the Pleistocene genera were covered with a sheath somewhat after the manner of the sheath in *Antilocapra*. Possibly

¹*Neomeryx anni* Parks, from Saskatchewan, type, three right mandibular molars and one incisor, may prove to be distinct, but the teeth in themselves are not definitely separable from teeth of the Recent pronghorn. (1925, Bull. Geol. Soc. Amer., XXXVI, p. 432, Pl. x.) *Platatherium pampeum* Ameghino, from the Upper Pampean of South America, type, end of horn-core, and referred dental fragments, appear too fragmentary for possible allocation, at least without an examination of the specimens themselves. The teeth of the *Platatherium* referred ramus, as figured, are certainly not of Antilocaprine form.

the sheath in *Hayoceros*, as in the Recent species, was provided with an anterior coreless prong. Ancestral forms of the symmetrically forked (*Plioceros*), *Texoceros* and *Stockoceros*, as suggested on a preceding page, may have given rise to *Hayoceros*, with disproportionately elongate posterior fork, *Capromeryx*, with reduced anterior fork, *Proantilocapra*, with abrogated anterior fork, and *Antilocapra*, with anterior fork absent but reproduced in the horny sheath.

Definite evidence of the Pleistocene occurrence of the pronghorn itself seems to be offered by remains from Rancho La Brea and McKittrick, California (see Furlong, 1932, Carn. Inst. Wash. Pub. 418, p. 32). Examples of Pleistocene, as of Late Tertiary, Antilocaprine horn-cores are extremely rare. The heads of three of the five here-described genera have been hypothetically reconstructed as in life on Fig. 49A, AA, D, page 468. The more characteristic of the specimens are also illustrated (Figs. 53, 54 and [in part] 52A). It is worthy of note that no yet known Pleistocene nor pre-Pleistocene dentition exhibits the p_4 with closed anterior fossette as in *Antilocapra*.

Summary of Named Species

The five Quaternary genera and subgenera, (horn characters) and species are:

SUBFAMILY 5.—STOCKOCEROTINÆ, CONTINUED

IX. *Stockoceros*, new subgenus.

Small to large-sized; symmetrically divided forks of circular cross section.

- (1) *Stockoceros conklingi* (Stock), subgenotypic species, from Shelter Cave, Organ Mountains, New Mexico.

SUBGENOTYPE.—Left horn-core on frontal fragment, L.A.M.174 [A.M. cast 27018]. This paper, Fig. 53.

- (2) *Stockoceros onusrosagris* (Roosevelt and Burden), from southern Arizona.

TYPE.—Skull with horn-cores, A.M.22488.

X. *Capromeryx*¹ Matthew.

Small-sized; diminutive anterior accessory fork and main posterior fork, extremities of both bent anteriorly.

- (1) *Capromeryx furcifer* Matthew, genotypic species, from Hay Springs, Sheridan County, Nebraska.

GENOTYPE.—Left ramal fragment, A.M.2771. This paper, *Fig. 54*.

- (1a) *Capromeryx furcifer*, var., from Stegomastodon Quarry, Brown County, Nebraska.

EXAMPLE.—Left ramus, F:A.M.31749. This paper, *Fig. 52A*.

- (1b) *Capromeryx gidleyi*, n.sp., from Benson, Arizona.

TYPE.—Portion of horn-core, F:A.M.23324.

- (2) *Capromeryx minor* Taylor, from Rancho La Brea, California.

TYPE.—Immature ramus, U.C.12523.

- (2a) *Capromeryx minor* Taylor, var., from McKittrick, California.

EXAMPLE.—Two upper and two lower molars and calcaneum, C.I.T. 15.

- (2b) (?) *Capromeryx* var., from Bautista Beds, California.

EXAMPLE.—Astragalus, etc., U.C.23527 (or 23527A).

- (3) *Capromeryx mexicana* Furlong, from Tequiquiac, Mexico.

TYPE.—Skull and large portion of skeleton, U.C.26648.

XI. *Tetrameryx*¹ Lull.

Large-sized; main anterior fork of slender circular cross section, and accessory tall posterior fork of heavier cross section, directed posteriorly and slightly twisted.

- (1) *Tetrameryx shuleri* Lull, genotypic species, from Dallas, Texas.

GENOTYPE.—Left maxilla and detached top of cranium with horn-core, So. Methodist Univ. 1.50 [A.M. cast 13220]. This paper, *Fig. 53*.

¹ "*Caproceros*" and "*Tetramoceros*," like *Dicranoceros* Hamilton Smith, would have been preferred for *Capromeryx* and *Tetrameryx*, the same having nothing in common with the deer.

- (2) (?) *Tetrameryx* (*Stockoceros* or *Hayoceros*) species, from Bautista Beds and San Timoteo Canyon, California.

EXAMPLE.—Portions of horn-cores, U.C.23420 (in part).

XII. *Hayoceros*, new subgenus.

Large-sized; main fork of blade of *Antilocapra*-like cross section, and secondary and posterior fork of slender, circular cross section, (?)taller and backwardly directed. Compare recently reported XIII A, *Ceratometryx* Gazin (page 533), of the "Upper Pliocene."

- (1) *Hayoceros falkenbachi*, n.subg. and sp., from Hay Springs, Sheridan County, Nebraska.

SUBGENOTYPE.—Left forked horn-core, F:A.M.25526. This paper, Fig. 53.

SUBFAMILY 6.—ANTILOCAPRINÆ, CONTINUED

XIII. *Antilocapra* Ord, referred.

Large-sized; unforked, blade-like horn-core, anterior edge sharp (as in anterior fork of *Hayoceros*), posterior edge round.

FIG. 54. Antilocaprini mandibular and maxillary dentitions from the Pleistocene, lateral views compared.

× 1.

F:A.M.17824B and 17824, (?) *Tetrameryx* (or *Hayoceros*) species, from San Timoteo Canyon, California.

(See page 532.)

F:A.M.25522 (rev.), 25689 (rev.), 25521, 25523 (rev.) and A.M.2771, genotype of *Capromeryx furcifer* Matthew, from Hay Springs, Sheridan County, Nebraska.

(See pages 528, 529.)

F:A.M.25684 (rev.), 25681 (rev.), 25680, A.M.2772 and F:A.M.25682 (rev.), *Hayoceros falkenbachi*, n.subg. and sp., ref., from Hay Springs, Sheridan County, Nebraska.

(See page 533.)

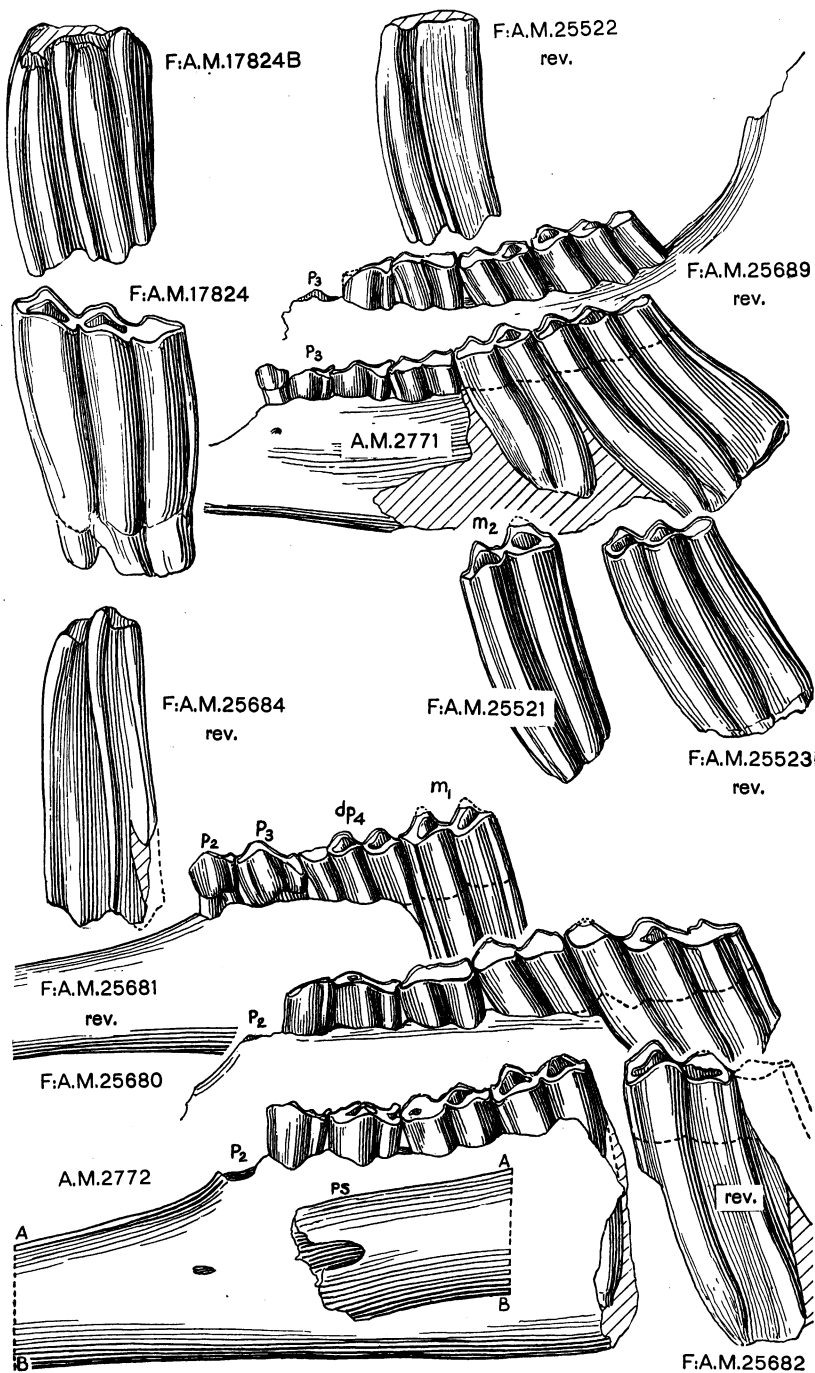


FIG. 54. Antilocapriini mandibular and maxillary dentitions from the Pleistocene, lateral views compared.

× 1. (See legend, preceding page.)

Detailed Lists of Types, Referred Specimens, and Synonymy

Total available specimens, 83: *Stockoceros*, 18; *Capromeryx*, 29; *Tetrameryx*, 8; *Hayoceros*, 24; *Ceratmeryx*, 2; *Antilocapra*, 2.

IX. STOCKOCEROS, NEW SUBGENUS

Reconstruction, Figure 49AA

The subgenotypic species, *S. (Tetrameryx) conklingi* (Stock), is based on a small symmetrically-forked horn-core from a New Mexico cave deposit.¹ A second and more magnificent species is seen in the Roosevelt-Burden form from a cave of southern Arizona. This species is unusually well represented by the remains discovered, collected and described by Quentin Roosevelt and J. W. Burden, and presented by them to the American Museum. Should the small *S. conklingi* type, as indicated by Stock, represent an immature individual, it is possible that the latter and the Roosevelt-Burden *Stockoceros onusrosagris* are closely allied. In the Arizona remains the teeth are somewhat smaller and the diastema longer-proportioned than in either the pronghorn or *Hayoceros*.

(1) *Stockoceros conklingi* (Stock), subgenotypic species

From Shelter Cave, New Mexico

Tetrameryx(?) conklingi STOCK, 1930, Los Ang. Mus. Pub. No. 2, p. 6, Figs. 1-3.

SUBGENOTYPE.—Left horn-core on frontal fragment.	L.A.M.174 [A.M.cast 27018]	From Shelter Cave, Organ Mountains, New Mexico. Figured by Stock, 1930, Fig. 1a; this paper, Fig. 53.
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REFERRED FROM TYPE LOCALITY.—

Partial (anterior) horn-core.	L.A.M.175	Figured by Stock, 1930, Fig. 1b.
Right toothless ramus.	L.A.M.176	Figured by Stock, 1930, Fig. 1c.

See humerus, radius, metacarpus and metatarsus listed under limb elements, page 536. Chester Stock finds the metapodials relatively heavier than in *Antilocapra*.

¹ Other remains from a New Mexican cave deposit are described by Edgar B. Howard and C. Bertrand Schultz (1935, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 283). The remains, which the writer has been privileged to see through the courtesy of Mr. Howard, are very similar to the Roosevelt-Burden *Stockoceros*.

(2) *Stockoceros onusrosagris* (Roosevelt and Burden)

From Southern Arizona

Tetrameryx onusrosagris ROOSEVELT AND BURDEN, 1934, Amer. Mus. Novitates, No. 754, p. 4, Fig. 1.

TYPE.—Skull with horn-cores, p ² -p ³ alveoli and p ⁴ -m ³ , premaxilla missing.	A.M.22488	Figured by Roosevelt and Burden, 1934, Fig. 1.
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REFERRED.—

Partial skull with right horn-core and m ¹ -m ² .	A.M.22489	This paper, Fig. 53.
Fragment of posterior ba- sal area of skull.	A.M.22484	
Five detached horn-cores.	A.M.22484	
Left ramus with p ₂ alveo- lus-m ₃ .	A.M.22490	Figured by Roosevelt and Burden, 1934, Fig. 1.
Ramal fragments.	A.M.22484	
Skeletal elements (see Limb Section, page 536).	A.M.22483	

X. *CAPROMERYX* MATTHEW

Reconstruction, Figure 49A

Horn-cores secured at Hay Springs by Charles Falkenbach and party witness the presence of both *Capromeryx* and *Hayoceros*. The latter is possibly represented as well by the large-sized antelopine-like teeth from the area, formerly referred to *Antilocapra*. The smaller genus also is witnessed by a partial horn-core secured by Joseph Rak from the Pleistocene in the vicinity of Benson, Arizona. Closely allied species have been described from the Pleistocene of Rancho La Brea and Mexico, and a possible occurrence of the genus has been noted in the Bautista Beds, California.

The *Capromeryx* horn-cores are less than half the size of *Antilocapra*; the anterior fork is rudimentary, the main fork flattened and bent anteriorly and deeply grooved posteriorly; both forks tend to curve slightly forward and converge; the horns are situated rather

posteriorly (the supra-orbital foramina being more median of the horn in *Antilocapra*); the bullæ (see Mexican) are greatly expanded; (the diastemata are said to be proportionately shorter than in *Antilocapra*); the teeth are characteristically Antilocaprine, except that the m_3 lacks the usual fourth lobe. The p_2 - p_3 seem proportionately smaller than in the larger-sized remains referred to *Hayoceros*.

William D. Matthew (1902) bases the genotypic species, *C. furcifer*, on a ramus from Hay Springs. He observes the latter to be about two-thirds the lineal diameter of *Antilocapra*, the premolars more nearly like *Merycodus*, and the molars as fully hypsodont as in *Antilocapra*, and that "... the new genus, *Capromeryx*, may, when better known, prove to be a transition between the antelope deer and *Antilocapra*..."

(1) ***Capromeryx furcifer* Matthew, genotypic species**

From Hay Springs, Sheridan County, Nebraska

Capromeryx furcifer MATTHEW, 1902, Bull. Amer. Mus. Nat. Hist., XVI, p. 318; 1904, *ibid.*, XX, p. 127, Fig. 20; 1909, Bull. No. 361, U. S. Geol. Surv., pp. 86, 87 (species not mentioned); 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, p. 227. HAY, 1924, Carn. Inst. Wash. Pub. 322A, p. 305.

GENOTYPE.—Left fragment with p_2 - m_3 .	A.M.2771	From Hay Springs, Nebraska, 1897. Figured by Matthew, 1904, Fig. 20; this paper, Fig. 54.
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REFERRED REMAINS SECURED BY THE CHARLES FALKENBACH PARTY.—

Left horn-core on cranial fragment.	F:A.M.25687	This paper, Fig. 53.
Left horn-core on cranial fragment.	F:A.M.25688	1930. This paper, Fig. 53.
Right fragment with p_3 roots, p_4 - m_3 .	F:A.M.25689	1929. This paper, Fig. 54.

Nine detached teeth:

Three m^3 s.	F:A.M.25522, A and B	This paper, Fig. 54.
m^2 .	F:A.M.25692	
Two m^1 s.	F:A.M.25693-4	
m_3 .	F:A.M.25523	This paper, Fig. 54.

Two m₂s.F:A.M.25521
and AThis paper, *Fig. 54.*

A metatarsus approximates that of (?) *Plioceros* var. (F:A.M.31513, 140 mm.) from Kansas, and is slightly larger than the specimen from Rancho La Brea figured by Taylor (1911, Fig. 3). (See referred limb elements, Limb Section, page 536.)

(1a) *Capromeryx furcifer*, Var.

From Stegomastodon Quarry, Brown County, Nebraska

Secured by Morris F. Skinner in the summer of 1934.

EXAMPLE.—Left ramus with
pr-m₁. (M+)

F:A.M.31749

This paper, *Fig. 52A.*(1b) *Capromeryx gidleyi*, new species

From Curtis Flats, Benson, Arizona

TYPE.—Portion of horn-core,
which apparently represents
the posterior and
main spike of the left side.

F:A.M.23324

Height = 90+ mm.

Cross section slender, four-sided and typically grooved anteriorly as in
Capromeryx.

(2) *Capromeryx minor* Taylor

From Rancho La Brea, California

Capromeryx(?) *minor* TAYLOR, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 192,
Figs. 1-6.

Capromeryx minor TAYLOR, CHANDLER, 1916, *ibid.*, IX, p. 111, Figs. 1-4.

TYPE.—Immature ramus.

U.C.12523

Figured by Taylor, 1911,
Fig. 1.

REFERRED.—

Immature ramal fragment.

U.C.12817

Figured by Taylor, 1911,
Fig. 2.

Metapodials, etc.

U.C.12516, etc.

(See Limb Section, page 536.)

Figured by Taylor, 1911,
Figs. 3-6.

REFERRED BY CHANDLER.—

Horn-core on portion of cranium, and detached upper and lower partial dentitions and limb elements.

Figured by Chandler, 1916, Figs. 1-4.

(2a) *Capromeryx minor* Taylor, Var.

From McKittrick, California

Capromeryx minor TAYLOR, FURLONG, 1930, Carn. Inst. Wash. Pub. 404, p. 51, Figs. 1 and 2.

EXAMPLE.—Two upper and two lower molars and cal-caneum.

C.I.T.15

Figured by Furlong, 1930, Figs. 1 and 2.

(2b) (?) *Capromeryx*, Var.

From Bautista Beds, California

Capromeryx?, sp. FRICK, 1921, Univ. Cal. Pub. Bull. Dept. Geol., XII, p. 300, Text-Figs. 15, 16.

EXAMPLE.—Astragalus, etc.

U.C.23527
(or 23527A)

Figured by Frick, 1921, Text-Figs. 15, 16.

(See Limb Section, page 537.)

(3) *Capromeryx mexicana* Furlong

From Tequixquiac, Mexico

Capromeryx mexicana FURLONG, 1925, Univ. Cal. Pub. Bull. Dept. Geol. Sci., XV, p. 145, Figs. 7-10.

TYPE.—Skull and large portion of skeleton.

U.C.26648

Figured by Furlong, 1925, Figs. 7-9.

REFERRED.—

Immature partial skull and limb elements.

U.C.26649

Figured by Furlong, 1925, Fig. 10 (dentition).

XI. TETRAMERYX LULL

(1) *Tetrameryx shuleri* Lull, genotypic species, 1921

From Dallas, Texas

Tetrameryx shuleri LULL, 1921, Amer. Journ. Sci. (5), II, p. 163, Figs. 2, 3.

GENOTYPE.—Left maxilla with p ³ -m ³ , and detached top of cranium with tall, deeply forked horn-core.	So. Methodist Univ. 1.50 [A.M.cast 13220]	From Lagow Sand Pit, Dal- las, Texas. Figured by Lull, 1921, Figs 2, 3; this paper, <i>Fig. 53</i> .
---	---	---

Ps/ small relative to ms/ and ms/ considerably larger than in Recent *Antilocapra*. R. S. Lull (1921, p. 167) observes: "There is no doubt that *Tetrameryx* represents an aberrant genus of the family Antilocapridæ, characterized by the heretofore unique feature of deciduous horn sheaths over permanent cores, and differing from the typical genus, which it closely resembles in size and dentition, by the presence of the additional posterior horn and probably by the absence of the distinctive 'prong' on the horn sheaths of the recent genus." According to the latter—

Breadth across orbits. = 112 mm.

Breadth between base of anterior horns = 44

Length anterior horns from orbital rim = 110

Length posterior horns from orbital rim = 297

TENTATIVELY REFERRED.—

Distal portion of left metatarsus.	F:A.M.31516	From Rock Creek, Texas, 1929.
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(See Limb Section, page 537.)

(2) (?)*Tetrameryx* (or *Hayoceros*) species

From Bautista and San Timoteo Canyon, California

Antilocapra?, one or more species, FRICK, 1921, Univ. Cal. Pub. Bull. Dept. Geol., XII, p. 300, Text-Fig. 18.

The portions of horn-cores and the different teeth listed below, from the Bautista and El Casco beds, indicate the local presence of large Antilocaprine individuals in addition to the questioned smaller form tentatively referred to *Capromeryx*. The Bautista core tips, as figured in 1921, are suggestive of the prong of *Tetrameryx*, *Stockoceros* or the smaller of the two prongs of *Hayoceros*.

EXAMPLE.—

From the Bautista Beds:

Portions of horn-cores.	U.C.23420 (in part)	Figured by Frick, 1921, Text- Fig. 18.
-------------------------	------------------------	---

From San Timoteo Canyon, southern California:

Left m ³ . (w)	F:A.M.17824B	This paper, <i>Fig. 54</i> .
Right m ¹ . (w+)	F:A.M.17826	
Left m ₃ . (w)	F:A.M.17824	This paper, <i>Fig. 54</i> .
(?)dp ₃ and dp ₄ .	F:A.M.17823	

Apparently Larger Size

(Teeth very large, m³ exceeding m³ of *T. shuleri* type maxilla.)

EXAMPLE.—Right maxillary specimen with m ¹ (br.)— m ³ (br.).	F:A.M.31861	From San Timoteo Canyon area. Collected by G. E. Hazen, 1934.
--	-------------	--

XII. HAYOCEROS, NEW SUBGENUS

Reconstruction, Figure 49D

(1) *Hayoceros falkenbachi*, new subgenus and species

From Hay Springs, Sheridan County, Nebraska

An unsymmetrically forked horn-core from the Hay Springs Pleistocene is referred to a new subgenus and species. The specimen, which was discovered by Charles Falkenbach in 1928, is unique in that the anterior fork is notably larger than the posterior. The anterior fork in cross section is sharply narrowed anteriorly and rounded posteriorly. The posterior fork (unfortunately broken near the base) is of cylindrical cross section, is directed posteriorly and has a prominent foramen at its median external root. The anteriorly narrowed blade-like anterior fork is at once suggestive of the core of *Antilocapra*. It is perhaps directed even more forward than in the latter. The resemblance between the anterior fork of the present specimen and that of *Antilocapra* has sug-

gested that the specimen was provided with a similar sheath and therefore was "six-pronged" (see head restoration, Fig. 49D). The metapodials, as seen in referred specimens, were of approximately the same length, but notably heavier than in *A. americana*.

SUBGENOTYPE.—Left forked horn - core (described above). F:A.M.25526 This paper, Fig. 53.

REFERRED TEETH FROM NIOBRARA RIVER, NEAR GRAYSON (referred by previous authors to *Antilocapra*, and forming the basis of the reported presence of the genus at Hay Springs).—

Left partial ramus with p_3 - m_2 . A.M.2772 This paper, Fig. 54.

Five detached teeth:

p^3 , m^2 , m^3 , m_2 and incisor. A.M.2773

REFERRED REMAINS SECURED BY THE CHARLES FALKENBACH PARTY, 1929-30.—

Left fragment with p_2 alveolus and p_3 (br.)- m_3 . F:A.M.25680 This paper, Fig. 54.

Right partial ramus with p_2 - p_3 and dp_4 - m_1 . F:A.M.25681 This paper, Fig. 54.

Three detached teeth:

m_3 . F:A.M.25682 This paper, Fig. 54.

m^3 (br.). F:A.M.25683

m^2 . F:A.M.25684 This paper, Fig. 54.

(See referred limb elements, Limb Section, page 537.)

XIIA. CERATOMERYX GAZIN

(1) *Ceratometryx prenticei* Gazin, genotypic species

From the Upper Pliocene of Idaho

Ceratometryx prenticei GAZIN, 1935, Journ. Pal., IX, p. 390, Fig. 1.

The description of this extremely interesting Stockocerotine has been received since the present report was put in press. The small-proportioned horn-cores of the figured specimen, and its occurrence in the Uppermost Pliocene, suggest the possibility of the same representing the female, or a somewhat immature individual, of a precursor of the Hay Springs genus. The posterior and inward position of the horn-cores differs from that in *Plioceros* and more resembles the condition in both *Stockoceros* and *Hayoceros*. The latter is particularly recalled because of the relative smallness of the posterior horn. In a referred specimen retaining the deciduous dentition, the horns are said to be smaller, transversely flattened and nearly of one size, and to resemble on a small scale, as seen in lateral view, the horns of the type of *Stockoceros* (*Tetrameryx*) *conklingi*. The author observes, "The occurrence of *C. prenticei* in the Upper Pliocene suggests that it may lie in or near an ancestral position to *Tetrameryx*, as known from the Dallas sand pits..."

GENOTYPE.—Cranial portion
of skull with 1st-5th cer-
vicals.

N.M.13760

From Hagerman Lake Beds,
Hagerman, Idaho.
Figured by Gazin, 1935,
Fig. 1.

(Approximate length of anterior horn, 74 mm.)

REFERRED.—

Immature skull, right hind
limb and 2d-4th dorsal
vertebræ.

N.M.13761

XIII. ANTILOCAPRA ORD, REFERRED

From the Pleistocene

A portion of an *Antilocapra* cranium with fairly complete left horn-core, L.A.M.Z885, and a right horn-core, C.I.T.46, have been reported by E. L. Furlong (1932, Carn. Inst. Wash. Pub. 418, p. 34) from Rancho La Brea and the McKittrick Beds of California. As no horn-core of *Antilocapra* has been found, so far, in the Hay Springs deposits, it is impossible to establish definitely the occurrence of this genus in that area where its presence would, of course, be expected. The teeth from Hay Springs are placed with the type horn-core of *Hayoceros*. Teeth from the San Timoteo-El Casco area, which may belong to *Antilocapra*, are referred similarly to the latter genus.

Hay (1923-1927) lists among the Quaternary occurrences of *Antilocapra*: Galena, Illinois; Wisconsin; Iowa; Kansas; Arizona; Contra Costa County and Concord Quadrangle, California; and Fossil Lake, Oregon.

Limb Elements Representing the Above Pleistocene Genera and Species

(For skulls, horn-cores and dentitions, see preceding section.)

Some eight of the species seem to be represented by limb elements; where the association is definite, the species are starred. (Compare species summary, page 522; and see measurement table, page 512.)

GENERA AND SPECIES RELISTED

IX. *Stockoceros*, NEW SUBGENUS

- (1) *S. conklingi* (Stock), referred, from Shelter Cave, New Mexico. (Limb Size Group II+.)
- (2) *S. onusrosagris* (Roosevelt and Burden), referred, from southern Arizona. (Limb Size Group A-I.)

X. *Capromeryx* MATTHEW

- (1) *C. furcifer* Matthew, referred, from Hay Springs, Sheridan County, Nebraska. (Limb Size Group II+.)
 - (2) *C. minor* Taylor, referred, from Rancho La Brea, California. (Limb Size Group II.)
 - * (2a) *C. minor* Taylor, var., from McKittrick, California.
 - (2b) (?) *C.* var., from Bautista Beds, California.
 - * (3) *C. mexicana* Furlong, from Tequixquiac, Mexico.
- Species (1a) and (1b) are not represented by limbs.

XI. *Tetrameryx* LULL

- (1) *T. shuleri* Lull, tentatively referred, from Rock Creek, Texas.

XII. *Hayoceros*, NEW SUBGENUS

- (1) *H. falkenbachii*, n.subg. and sp., referred, from Hay Springs, Sheridan County, Nebraska. (Limb Size Group AA-I, approximating Limb Size Group II of the Dromomerycini series.)

XIII. *Antilocapra* ORD

(See measurements, Recent species, page 512.)

DETAILED LISTS OF LIMB ELEMENTS OF THE ABOVE GENERA AND SPECIES

IX. *Stockoceros*, NEW SUBGENUS(1) *S. conklini* (Stock), referred

From Shelter Cave, New Mexico

Humerus and radius.	L.A.M. 179 and 180	Figured by Stock, 1930, Fig. 2.
Metacarpus and metatarsus.	L.A.M. 185 and 187	Figured by Stock, 1930, Fig. 3.

According to Chester Stock, metacarpus, *T. conklini*, 153.6–147.5 mm. versus *Capromeryx*, 146.7, and *Antilocapra*, 218.4; metatarsus, 165.6 mm. versus *Capromeryx*, 161.7, and *Antilocapra*, 229.

(2) *S. onusrosagris* (Roosevelt and Burden), referred

From Southern Arizona

Skeletal elements of several individuals, including one ulnoradius (br.), distal half of second and top of ulna; metacarpus, tibia and metatarsus; etc. fragments.	A.M. 22483	Radius = 193 mm. Metacarpus = 193 Tibia = 276 Metatarsus = 207
--	------------	---

X. *Capromeryx* MATTHEW(1) *C. furcifer* Matthew, referred

From Hay Springs, Sheridan County, Nebraska

Distal portion left humerus.	F.A.M. 25673
Left metatarsus. Length = 164 mm.	F.A.M. 25672
Astragalus (br.).	F.A.M. 25672A

(2) *C. minor* Taylor, referred

From Rancho La Brea, California

REFERRED.—

Left metatarsus, distal one-half metacarpus, astragalus and one 3d phalanx.	U.C. 12516, 10970, 12520 and 12521	Figured by Taylor, 1911, Figs. 3–6.
---	--	--

Metatarsus = 150 mm. (Fig. 3).

REFERRED BY CHANDLER, 1916.—

"Limb elements."

(2a) *C. minor* Taylor, Var.
From McKittrick, California

EXAMPLE.—Calcaneum. C.I.T.15 Figured by Furlong, 1930,
Fig. 2.
According to Furlong (1930, p. 51), presumably associated with upper and lower molars.

(2b) (?)*C.* Var.
From Bautista Beds, California

EXAMPLE.—Astragalus and U.C.23527 Figured by Frick, 1921, Text-
section of a distal end of (or 23527A) Figs. 15, 16.
an associated metapodial.

(3) *C. mexicana* Furlong
From Tequiquiac, Mexico
TYPE (in part).—"Large por- U.C.26648
tion of skeleton."
(See associated skull, page 530.)

REFERRED.—
"Limb elements." U.C.26649
(See associated immature partial skull, page 530.)

XI. *Tetrameryx* LULL

(1) *T. shuleri* Lull, tentatively referred
From Rock Creek, Texas, 1929

Distal portion of left metatarsus..... F:A.M.
31516

XII. *Hayoceros*, NEW SUBGENUS

(1) *H. falkenbachi*, n.subg. and sp., referred
From Hay Springs, Sheridan County, Nebraska
(Size approximating *Dromomerycini* Limb Size Groups II to III.)
(Heavier than *Antilocapra americana*, A.M. [M.] 19350.)

Two specimens secured by the Charles Falkenbach party, 1929-30: F:A.M.
Distal one-half right humerus..... 25671
Left metacarpus (br.)..... 25670

American Museum specimens from the Niobrara River near Grayson, Sheridan
County, 1897: A.M.
Distal four-fifths right tibia..... 2775
Right metatarsus, 223 mm..... 2774
1st phalanx..... 2774
Two 1st phalanges and five astragali.

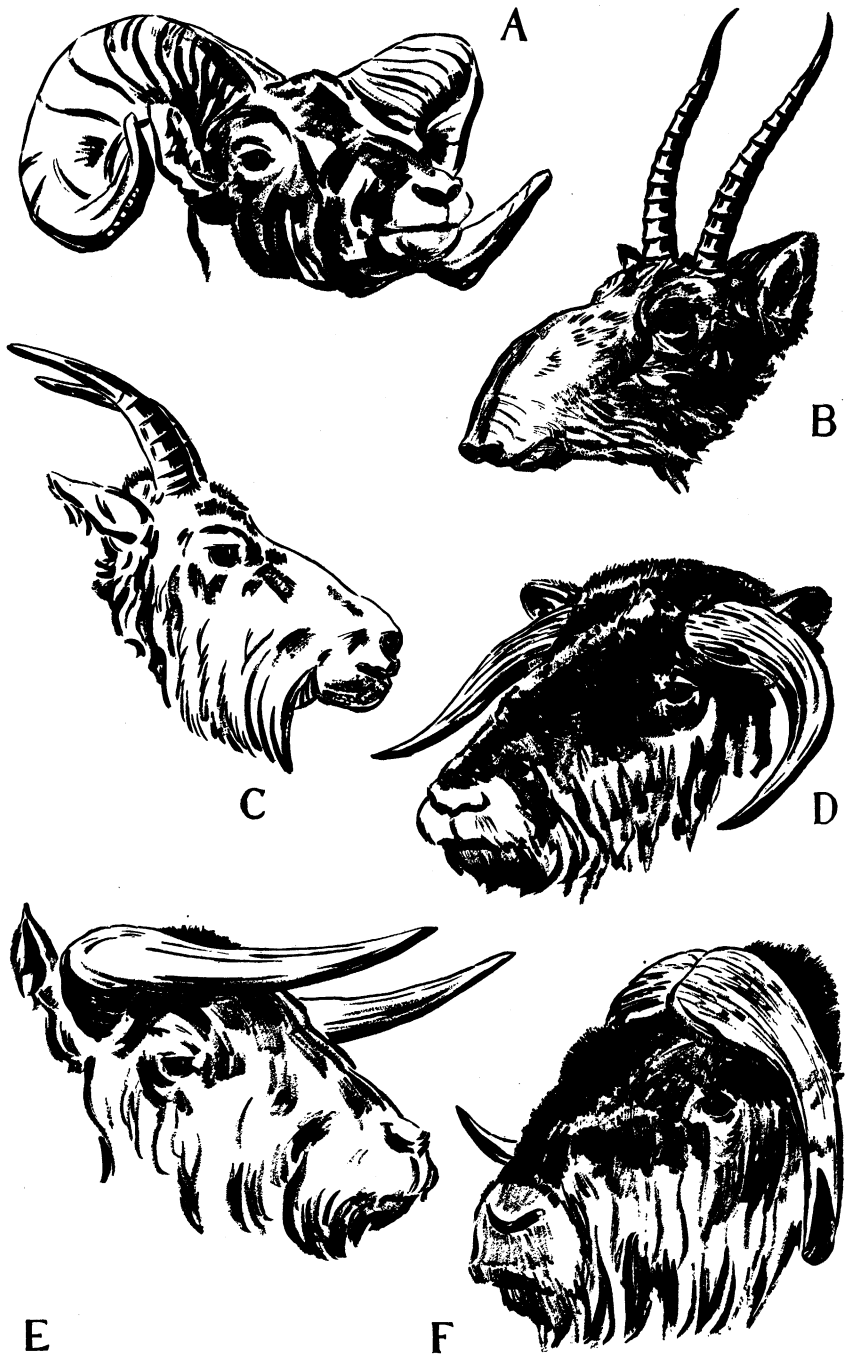


FIG. 55. Bovids of the American Quaternary.

Heads in flesh $\times$ approximately $\frac{1}{2}$. (See legend, page 540.)

Mountain Sheep (A)

Ovis Linnæus

Mountain Goat (C)

Oreamnos Rafinesque

Furlong's Antelope (E)

Preptoceras Furlong

Saiga (B)

Saiga Gray

Leidy's Muskox (D)

Bootherium Leidy

Muskox (F)

Ovibos Blainville

FAMILY III.—BOVIDÆ

DIVISIONS A.—ANTILOPINI; B.—OVINI; AND C.—BOVINI

Figures 55-58 and (in part) 2A

Exploration of the Western Tertiary has failed as yet to shed light on the antecedents of the American Cavicornia, which so far have not been definitely recognized in deposits of the Western Hemisphere preceding those of Pleistocene time. A possible exception exists in the case of *Neotragocerus* Matthew and Cook, as there is still question as to the stratigraphic level of the lone evidence, a Nebraska horn-core, and whether the same may not have been derived from the pre-Pleistocene.¹

The known American Quaternary Cavicornia may be considered conveniently as representative of five major subfamily groups, one of which—the extinct Euceratherinæ of the Pacific slope—was perhaps indigenous, but four of which—the Antilopinæ, Ovinæ, Ovibovinæ and Bovinæ—were probably of Old World origin. The most interesting of the five groups is that embracing the three aberrant Antilopines, the questioned *Neotragocerus*, the *Saiga*, here first described from America, and the surviving American goat-antelope, *Oreamnos*. The rarity of Quaternary remains of the latter and of the mountain sheep is due undoubtedly to habitat. The Ovinæ, Ovibovinæ and Bovinæ ranged in the Pleistocene throughout the Holarctic regions of both hemispheres. The recent discovery in Alaska of a small Ovine of the proportions of individuals of the domesticated race is unexpected. In Quaternary America the Ovibovines had a wide distribution and were represented by at least three distinct genera. The bison, previous to the recent discovery of the remains of the yak-like creature described below from the Quaternary of Alaska, was believed to have been the only Bovine to have reached America. The Alaskan Bovidæ are to be further discussed in a forthcoming study of the amassed evidence regarding the extinct fauna of the Fairbanks region. Observations on Quaternary forms are confined here to brief statements as to the genera and species, an enumeration of the types and synonymy and a list of the more important of the present available specimens.

¹ Reports of the occurrence of *Bison* in pre-Pleistocene deposits are not substantiated by the evidence. Marsh (1877) is generally considered as having been in error in assigning the types of *B. alleni* and *B. ferox* to the "Lower Pliocene." *Bison* was doubtfully reported from the Snake Creek of Nebraska by Matthew and Cook (1909): "... we do not regard the presence of this Pleistocene genus in the Snake Creek fauna as satisfactorily proven." Matthew (1924) did not include *Bison* in the fauna from the Snake-Sheep Creek area.

The three present recognized divisions, five subfamilies and twelve genera and subgenera of American Pleistocene-Recent Bovidae are:

DIVISION A.—ANTILOPINI

Subfamily 1.—ANTILOPINÆ

- I. *Neotragocerus* Matthew and Cook (1909)
(Possibly from the Tertiary)
- II. *Oreamnos* Rafinesque (1817)
- III. *Saiga* Gray (1843) (*S. ricei*, n.sp., from Alaska)

DIVISION B.—OVINI

Subfamily 2.—EUCERATHERINÆ

- IV. *Euceratherium* Furlong and Sinclair (1904)
- V. *Preptoceras* Furlong (1905), and questioned
 - (a) *Aftonius* Hay (1913), and
 - (b) *Taurotragus* ref. Gidley (1913)

Subfamily 3.—OVINÆ

- VI. *Ovis* Linnæus (1758) (*O. dorshi*, n.sp., from Alaska)

Subfamily 4.—OVIBOVINÆ

- VII. *Ovibos* Blainville (1816)
(*Liops* Gidley and *Gidleya* Cossmann)
- VIII. *Symbos* Osgood (1905)
- IX. *Boötherium* Leidy (1852)

DIVISION C.—BOVINI

Subfamily 5.—BOVINÆ

- X. *Bos* Linnæus (1758) (*B. bunnelli*, n.sp., from Alaska)
- XI. *Bison* H. Smith (1827)
- XII. *Superbison* Nobis (1930)

FIG. 55. Details of Bovidae heads in flesh:

- (A) *Ovis dalli stonei* (Allen)
- (C) *Oreamnos americanus columbiæ* Hollister
a and c after specimens shot by author, Cassiar Province, B. C., 1910
- (B) *Saiga ricei*, n.sp., restored from photograph of Recent *Saiga*, Morden-Graves
North Asiatic Expedition
- (D) *Boötherium sargenti* Gidley, hypothetical reconstruction
- (E) *Preptoceras sinclairi* Furlong, hypothetical reconstruction
- (F) *Ovibos moschatus* (Zimmerman), after Recent specimen

The marked difference between the limb proportions of the several genera is indicated in the adjoining table of metacarpal versus skull lengths.

TABLE XII

METACARPAL LENGTH RELATIVE TO SKULL LENGTH IN THE AMERICAN ANTILOPINÆ,
OVINÆ, OVIBOVINÆ AND BOVINÆ, VERSUS IN *Antilocapra*
(Skull length measured from back of condyles to front of premaxillæ.)

<i>Antilocapra americana</i> .	♀	A.M.(M.)19350	N. Y. Zoo	$\frac{220}{265} = 83\%1$
" " ..	♂	" 75243	Wyoming	$\frac{206}{275} = 75\%$
" " ..	♂	" 100353	"	$\frac{204}{275} = 74\%$
<i>Saiga tatarica</i>	♂	" 85301	Asia	$\frac{157}{235} = 67\%$
<i>Euceratherium sinclairi</i>	Im- ma- ture	U.C.8896	California	$\frac{180}{183} = 66\%$
<i>Ovis canadensis</i>	♀	A.M.(M.)122672	Alberta	$\frac{278}{184} = 64\%$
" "	♂	" 122673	"	$\frac{239}{103} = 40\%$
<i>Oreamnos montanus</i> ...	♂	" 35541	N. Y. Zoo	$\frac{252}{110} = 37\%$
" " ...	♂	" 35405	"	$\frac{300}{182} = 39\%$
<i>Ovibos moschatus</i>	♂	" 19346	Hudson Bay	$\frac{465}{225} = 41\%$
<i>Bison bison athabascæ</i> .	♂	" 98953	Alberta	$\frac{550}{205} = 39\%$
" " " ...	♀	" 98954	"	$\frac{523}{241} = ((43))\%$
<i>Superbison crassicornis</i>	♂	A.C.-F:A.M. Coll. (Unassociated)	Alaska	$\frac{560}{196} = ((39))\%$
" " ...	♀	"	"	$\frac{500}{151} = 35\%$
<i>Bos grunniens</i>	♂	A.M.(M.)10730	N. Y. Zoo	

¹ Length metacarpus
Length skull

The three Bovidæ divisions and the available remains referable to each are discussed in the following pages.

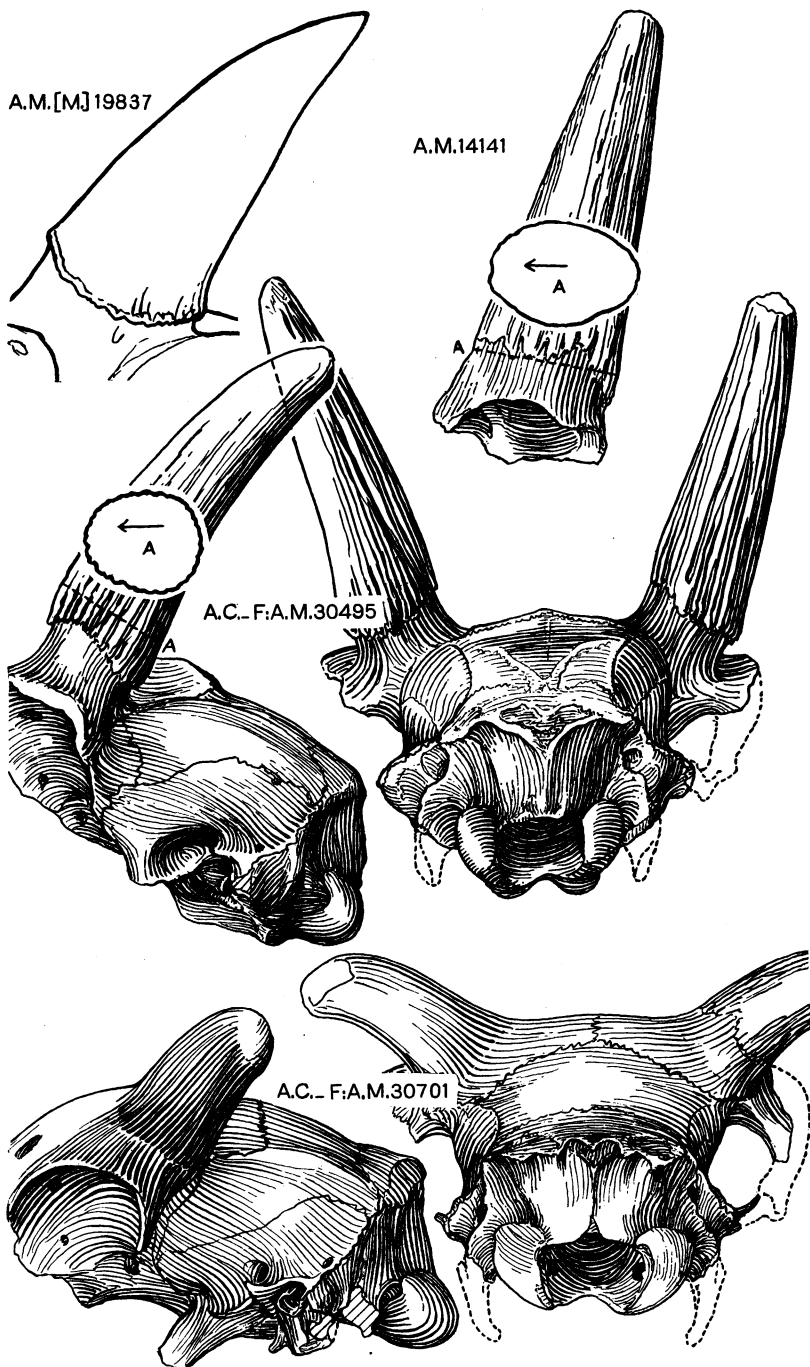


FIG. 56. *Oreamnos* Raf. (A.M.[M.]19837), *Neotragocerus* M. and C. (A.M.14141), *Saiga ricei*, n.sp. (A.C.-F.A.M.30495, type) and *Ovis dorshi*, n.sp. (A.C.-F.A.M.30701, type), comparison of horn-cores.

× 1/2. (See legend, next page.)

DIVISION A.—ANTILOPINI

Subfamily 1.—*Antilopinae*

I. *NEOTRAGOCERUS* MATTHEW AND COOK

(Questioned Tertiary Occurrence)

II. *OREAMNOS* RAFINESQUE

III. *SAIGA* GRAY

Figures 55B, c and (in part) 2A, 56

The most interesting of the five Bovid groups occurring in North America, as observed in the foreword, is that of the *Antilopinae*, embracing the questioned *Neotragocerus*, the *Saiga*, here first described from America, and the Recent *Oreamnos*. The rarity of remains of all three genera well may have been occasioned by their Alpine habitat.

I. *NEOTRAGOCERUS* MATTHEW AND COOK

Figure (in part) 56

The genus was based (1909) on a horn-core reported as coming from the Upper Snake Creek, Nebraska. John C. Merriam (1918) referred to the genus under a separate species a horn-core from the late Pliocene or early Pleistocene of Oregon. The original describers, speaking of the type, observe: "Its surface is that of the horn cores of *Bovidæ*, easily distinguished from the horn core of the Pronghorn Antelope by the coarser and less compact structure of the surface... It approaches *Oreamnus* in form and surface about as nearly as any modern genus with which we have made comparison, but lacks the curvature of that genus."

FIG. 56. *Oreamnos* Raf., *Neotragocerus* M. and C., *Saiga ricei*, n.sp., and *Ovis dorshi*, n.sp., comparison of horn-cores.

× ½. A, cross sections of horn-cores.

A.M.[M.]19837, *Oreamnos montanus* (Ord) (Recent, for comparison).

(See page 545.)

A.M.14141, *Neotragocerus improvisus* Matthew and Cook, genotype, from the Tertiary of western Nebraska.

(See page 544.)

A.C.-F:A.M.30495, *Saiga ricei*, n.sp., type, from the Pleistocene of Alaska.

(See page 547.)

A.C.-F:A.M.30701, *Ovis dorshi*, n.sp., type, from the Pleistocene of Alaska.

(See page 555.)

Two species have been recognized:

- (1) *Neotragocerus improvisus* Matthew and Cook, genotypic species, from Snake Creek, Sioux County, Nebraska.

GENOTYPE.—Horn-core, A.M.14141. This paper, *Fig. 56*.

- (2) (?) *Neotragocerus lindgreni* Merriam, from the Idaho formation.

TYPE.—Horn-core, N.M.3941.

Detailed Lists of Types, Referred Specimens, and Synonymy

- (1) *Neotragocerus improvisus* Matthew and Cook, genotypic species

From the *Hipparion* Zone, Snake Creek, Sioux County, Nebraska

Neotragocerus improvisus MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 413, Figs. 26, 27. SINCLAIR, 1915, Proc. Amer. Phil. Soc., LIV, p. 94, Fig. 16. MATTHEW, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, p. 222.

GENOTYPE.—Horn-core.

A.M.14141

Figured by Matthew and Cook, 1909, Fig. 26; this paper, *Fig. 56*.

There is serious doubt as to the previous provisional references of partial dentitions:

Two maxillary fragments
with m^1-m^2 .
(Apparently camel.)

A.M.14136
and 14133

Provisionally referred and figured by Matthew and Cook, 1909, Fig. 27.

Ramus with p_4-m_3 .
(Here tentatively transferred to *Prosynthetoceras siouzensis*, n.sp.—see page 607.)

P.U.12106

Provisionally referred and figured by Sinclair, 1915, Fig. 16.

- (2) (?) *Neotragocerus lindgreni* Merriam

From the Idaho Formation

Neotragocerus lindgreni MERRIAM, 1918, Univ. Cal. Pub. Bull. Dept. Geol., X, p. 526, Fig. 2.

TYPE.—Horn-core. N.M.3941 From the Idaho formation, 3 mi. E. of Boise.
Figured by Merriam, 1918, Fig. 2.

Said to be slenderer and perhaps more compressed laterally than in *N. improvisus* Matthew and Cook, and longer, slenderer and more distinctly flattened transversely than in *Oreamnos*.

II. OREAMNOS RAFINESQUE (1817)¹

Head in Flesh, Figure 55c; and (in part) 2A, 56

Remains of the peculiar American goat-antelope, the White or Rocky Mountain "goat," *Oreamnos montanus* (Ord) (see outline of horn-core, Fig. 56), of Recent North America, seldom are encountered in Quaternary deposits. The species, as noted below, was identified (a) by Matthew (1902) from Whitman County, Washington; (b) by Sinclair (1905) in foot elements from Potter Creek Cave, California; and more recently (1925) (c) by Chester Stock, in additional remains from Potter Creek and Samwel Caves. *Oreamnos* so far is unrepresented in the Fairbanks, Alaska, collection.

The genotypic species is *Oreamnos montanus* (Ord, 1815), the *Rupicapra americana* of Blainville, 1816. Three Recent local races or subspecies have been named: *O. montanus kennedyi* (Elliot, 1900) from southern Alaska; *O. montanus columbiæ* (Hollister, 1912) from northern British Columbia; and *O. montanus missoulæ* (Allen, 1904) from Montana and Idaho.

The three Quaternary references are:

(1a) *Oreamnos montanus*, Var.

From Whitman County, Washington

Oreamnos species indet. MATTHEW, 1902, Bull. Amer. Mus. Nat. Hist., XVI, p. 321.

EXAMPLE.—Parts of horn.

(Whereabouts unknown.)

¹ 1817, *Oreamnos* Rafinesque, Amer. Monthly Magazine, II, p. 44 (November). TYPE.—*Mazama dorsata* Rafinesque = *Ovis montanus* Ord (1815) = *Rupicapra americana* Blainville (1816)

(1b) *Oreamnos montanus*, Var.

From Potter Creek Cave, California

Haplocerus montanus ORD, referred SINCLAIR, 1904, Univ. Cal. Pub. Amer. Arch. Ethn., II, p. 18.

Aplocerus montanus ORD, referred SINCLAIR, 1905, Univ. Cal. Pub. Bull. Dept. Geol., IV, p. 152, Pl. xx, Figs. 3, 4.

Oreamnos americanus (ORD), MERRIAM AND STOCK, 1925, Carn. Inst. Wash. Pub. 347, p. 10.

EXAMPLE.—Parts of two metacarp.

U.C.4312
and 4382

Figured by Sinclair, 1905, Pl. xx, Figs. 3, 4.

(1c) *Oreamnos montanus*, Var.

From Samwel Cave, California

Oreamnos species STOCK, 1925, Carn. Inst. Wash. Pub. 331, p. 113.

Remains not reported.

III. SAIGA GRAY¹

Head in Flesh, Figure 55B; and (in part) 56

It is surprising to find the strange Asiatic gazelle-antelope, *Saiga*, occurring in the Quaternary fauna of Alaska. While the range of *Saiga* today is reduced to the steppes of western Siberia, the genus is said to have extended into Poland as late as 1800 and to have been present in France in Palæolithic time. Smith Woodward (1890) identifies it in the Quaternary of the British Isles. *Saiga* is represented in the Alaska collection by a portion of the skull, inclusive of the horn-cores, posterior portion of the frontals and the occiput (Fig. 56). There would seem to be little question as to the correctness of the identification of the specimen. The same is characterized by the typical elevation of the frontal and frontoparietal sutures in respect to the depression of the bones themselves, the strong angulation of the posterior cranium, the elevation of the superior border of the orbit, the extent of the parietals and

¹ *Saiga tatarica* Gray (1843, List Mamm. Brit. Mus., p. 160) = *Capra tatarica* Linnaeus (1766 Syst. Nat. [12], I, p. 97).

of the mastoids, the height of the smooth horn-core bases as contrasted with the deeply fluted horn-cores, the breadth between the horn bases, and the outwardly and backwardly sweeping, laterally compressed and sharply tapering horn-cores which are slightly bowed medianly as viewed anteriorly. The distance between the mid-anterior horn bases approximates that from theinion to the mid-horn base. The sutures of the specimen are but little consolidated, indicating an adolescent individual.

The Alaska specimen approximates very closely an Asiatic skull [A.M. (M.)85301] in the Morden collection. The latter exhibits the diminutive size of I_3 and $/C, p_2$ (minute alveoli) missing, p_3^3 small, tooth crowns tall, nasals abbreviated and anterosuperior portions of the maxillæ greatly attenuated. Nehring (1891) reports the presence of three premolars in the case of remains from Moravia, Czechoslovakia. While the horn-cores of the saiga are in moderate degree not unsuggestive of the Rocky Mountain goat, the serow and the goral, they more closely resemble those of the goitered gazelle of Asia, *Gazella subgutturosa*. The only specimen available of the latter [A.M.(M.)60381] represents a slightly immature individual that is of considerably smaller size than the Asiatic and Alaska saigas. The *G. subgutturosa* specimen and a mature specimen of *Gazella granti* [A.M.(M.)54150] exhibit a suggestion of the elevation of the frontal and frontoparietal sutures characteristic of *Saiga*. The new species is named in honor of Neil A. Rice, in recognition of his support of the Alaska investigations. A partial metacarpus and partial metatarsus of proportions of the Recent Asiatic form may represent the same new species. It is expected that continued investigation in the Fairbanks area may produce additional remains. A more detailed description of the new type will be given in the forthcoming report on the Pleistocene Fauna of Alaska.

(1) *Saiga ricei*, new species

From the Fairbanks Area, Alaska

TYPE.—Posterior half of cranium with horn-cores. A.C.-F:A.M.30495 From Lillian Creek, 1930.
This paper, *Fig. 56*.

TENTATIVELY REFERRED.—

Proximal one-half right A.C.-F:A.M.30503 From Gilmore, 1931.
metacarpus.

Proximal two-thirds right A.C.-F:A.M.30503A From Goldstream, 1933.
metatarsus.

DIVISION B.—OVINI

Subfamily 2.—*Euceratherinae*

IV. *EUCERATHERIUM* FURLONG AND SINCLAIR

V. *PREPTOCERAS* FURLONG, AND QUESTIONED

(a) *AFTONIUS* HAY AND (b) *TAUROTRAGUS* REF. GIDLEY

Reconstruction, Figure 55E

Statement

Euceratherium Furlong and Sinclair (1904) and *Preptoceras* Furlong (1905) (see reconstruction, Fig. 55E) from the California Quaternary caves, *Aftonius* Hay (1913) from the Iowa Pleistocene, and *Taurotragus*, referred Gidley (1913), from a Maryland cave, possibly represent a single group of closely related forms. Stock-Furlong (1927), in their consideration of remains from McKittrick, observe "... In view of possible variation in the characters of the horn cores, the suggestion may be warranted that the McKittrick form and the [two] types from the California caves [*Preptoceras* and *Euceratherium*] represent in reality a single generic group. Should this prove to be the case the type of *Preptoceras* would possibly belong to a young male and the type of *Euceratherium* to an older female... Undoubtedly the greatest similarity exists between the California Pleistocene types and *Ovibos*... How closely the ... group is related to the Pleistocene and Recent musk oxen can best be determined when information is available concerning the Pliocene precursors of these forms." The horn-core on which *Aftonius* Hay is based is suggestive of the California specimens. *Taurotragus americanus* Gidley, as pointed out by C. L. Gazin, seems to be related to the American *Euceratherium* rather than to the African *Taurotragus* group. It is always possible that the types of the two Samwel Cave genotypic species, *Euceratherium collinum* and *Preptoceras sinclairi*, may be of a female and an immature male of the same genus. For the present *Preptoceras* well may be retained as a distinct subgenus characterized by the less tall and upright, and more horizontally directed and widely spreading horn-cores.

The ten more prominent of the recorded occurrences of the remains of *Euceratherinae* are given (the first five being from California areas). The types and synonymy are cited in the following pages.

Summary of Named Species

- (1) *Euceratherium collinum* Furlong and Sinclair, genotypic species, from Samwel Cave, Shasta County, California.

GENOTYPE.—Partial cranium, U.C."M"8751.

- (1a) *E. (Preptoceras) sinclairi* (Furlong), from Samwel Cave, Shasta County, California.

TYPE.—Partial skull, mandible and skeleton, U.C.8896.

- (2) *Euceratherium collinum*, referred Sinclair, from Potter Creek Cave, Shasta County, California.

EXAMPLE.—Broken horn-cores, etc., U.C. Coll.

- (3) *Euceratherium collinum*, referred Stock, from Hawver Cave, Eldorado County, California.

EXAMPLE.—Detached molars, U.C.21467-8.

- (4) *Euceratherium* species, referred Stock-Furlong, from Klamath River, Siskiyou County, California.

EXAMPLE.—Horn-core, U.C."M"2337.

- (5) *E. (Preptoceras)* species, referred, from McKittrick, California.

EXAMPLE.—Partial skull, right ramus and foot, U.C."M"27118-9.

- (6) (?) *E. (Preptoceras) mayfieldi* (Troxell), from Rock Creek, Texas.

TYPE.—Partial skull and horn-cores, Y.P.M.10920.

- (7) (?) *E. (Aftonius) calvini* (Hay), from Missouri Valley, Iowa.

TYPE.—Pair of horn-cores, Univ. Iowa Coll.

- (8) (?) *E. (Taurotragus) americanum* (Gidley), from Cumberland Cave, Maryland.

TYPE.—Right maxillary dentition, N.M.7622.

- (8a) (?) *Euceratherium americanum* (Gidley), referred Gazin, from the vicinity of Alton, Illinois.

EXAMPLE.—Lower left molar, N.M.3987.

- (9) *Euceratherium collinum morrissi* Schultz and Howard, from Burnet Cave, New Mexico.

TYPE.—Posterior portion of skull with horn-cores, A.N.S.P.13418.

- (9a) (?)*E. (Preptoceras) sinclairi neomexicana* (Schultz and Howard), from Burnet Cave, New Mexico.

TYPE.—Left horn-core, A.N.S.P.13807.

- (10) (?)*E. (Preptoceras) cf. sinclairi*, referred Freudentberg, from the Valley of Mexico.

Detailed Lists of Types, Referred Specimens, and Synonymy

- (1) *Euceratherium collinum* Furlong and Sinclair, genotypic species

From Samwel Cave, Sierra Nevada Range, Shasta County, California

Euceratherium collinum FURLONG AND SINCLAIR, SINCLAIR, 1904, Univ. Cal. Pub. Amer. Arch. Ethn., II, p. 18. SINCLAIR AND FURLONG, 1904, Univ. Cal. Pub. Bull. Dept. Geol., III, p. 412, Pls. L, LI and Text-Fig. 1.

GENOTYPE.—Partial cranium with horns and cheek- tooth series.	U.C."M"8751	Figured by Sinclair and Fur- long, 1904, Pls. L, LI and Text-Fig. 1.
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The genotype, which may be of a female, and the type of *Preptoceras sinclairi* Furlong, an immature male from the same locality, may represent but one form.

- (1a) *Euceratherium (Preptoceras) sinclairi* (Furlong)

From Samwel Cave, Sierra Nevada Range, Shasta County, California

Preptoceras sinclairi FURLONG, 1905, Univ. Cal. Pub. Bull. Dept. Geol., IV, p. 163, Pls. XXIV, XXV. GAZIN, 1933, Journ. Mamm., XIV, No. 2, p. 163.

TYPE.—Partial skull, man- dible, and skeleton of young individual.	U.C.8896	Figured by Furlong, 1905, Pl. XXIV and (skeleton) Pl. XXV.
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(Length of the metacarpal 180 mm., and the metatarsal 190 mm., according to Furlong.)

Furlong (1905, p. 168) states: "... Its closest affinity is with its contemporary *Euceratherium*. It stands in about the same relation to the Ovinæ as does the latter and is tentatively placed in that subfamily..." The type, probably an immature

male, as pointed out by Gazin (1933), actually may be of *E. collinum* Furlong and Sinclair, from the same cave.

(2) *Euceratherium collinum*, referred Sinclair

From Potter Creek Cave, Sierra Nevada Range, Shasta County, California

Euceratherium collinum FURLONG AND SINCLAIR, referred SINCLAIR, 1905, Univ. Cal. Pub. Bull. Dept. Geol., IV, p. 150, Pl. xx, Figs. 1, 2.

EXAMPLE.—Broken h o r n- cores, detached teeth and foot-bones.	U.C. Coll.	Foot-bones figured by Sin- clair, 1905, Pl. xx, Figs. 1, 2.
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(3) *Euceratherium collinum*, referred Stock

From Hawver Cave, Eldorado County, California

Euceratherium collinum (?) SINCLAIR AND FURLONG, referred STOCK, 1918, Univ. Cal. Pub. Bull. Dept. Geol., X, p. 513.

EXAMPLE.—Detached molars.	U.C.21467 and 21468
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(4) *Euceratherium* species, referred Stock-Furlong

From Klamath River, Gottle, Siskiyou County, California

Euceratherium species, referred STOCK-FURLONG, 1927, Univ. Cal. Pub. Bull. Dept. Geol. Sci., XVI, p. 413, Fig. 1.

EXAMPLE.—Horn-core.	U.C."M"2337	Figured by Stock-Furlong, 1927, Fig. 1.
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(5) *Euceratherium* (*Preptoceras*) species, referred

From McKittrick, California

Preptoceras ? cf. *sinclairi* FURLONG, STOCK-FURLONG, 1927, Univ. Cal. Pub. Bull. Dept. Geol. Sci., XVI, p. 410, Figs. 2-5 and Pls. LX-LXIII.

Preptoceras sinclairi FURLONG, GAZIN, 1933, Journ. Mamm., XIV, No. 2, p. 163.

EXAMPLE.—Partial skull, right ramus, and foot.	U.C."M"27118 and 27119	Figured by Stock-Furlong, 1927, (skull) Pls LX-LXII, (ramus) Pl. LXIII, (foot) Text-Fig. 5.
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(Stock-Furlong and Gazin agree in the resemblance of these remains to *Eucera-therium*.)

(6) (?) *Euceratherium* (*Preptoceras*) *mayfieldi* (Troxell)

From Rock Creek, Texas

Preptoceras mayfieldi TROXELL, 1915, Amer. Journ. Sci. (4), XL, p. 479, Figs. 1, 2.

TYPE.—Partial skull and horn-cores. Y.P.M.10920 Figured by Troxell, 1915, Figs. 1, 2.

(7) (?) *Euceratherium* (*Aftonius*) *calvini* (Hay)

From the Pleistocene of Iowa

"Ruminant" CALVIN, 1909, Bull. Geol. Soc. Amer., XX, p. 350, Pl. xxiii, Fig. 1.
Aftonius calvini HAY, 1913, Proc. Biol. Soc. Wash., XXVI, p. 6; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, pp. 26, 287, Pl. xxxiv, Figs. 1, 2, 4, 5, and Text-Fig. 95; 1923, Carn. Inst. Wash. Pub. 322, p. 14 (records from Iowa, Missouri and Kansas); 1924, *ibid.*, Pub. 322a, p. 296; 1928, Journ. Wash. Acad. Sci., XVIII, p. 425.

TYPE.—Pair of horn-cores with portion of frontals. Univ. Iowa Coll. From Cox Gravel Pit, Missouri Valley, Harrison County, Iowa.
 Figured by Calvin, 1909, Pl. xxiii, Fig. 1; by Hay, 1914, Pl. xxxiv, Figs. 4, 5 and Text-Fig. 95.

TENTATIVELY REFERRED BY HAY, 1914.—

Left metatarsus. Univ. Iowa Coll. From Turin, Monona County, Iowa.
 (Length 204 mm.) Figured by Hay, 1914, Pl. xxxiv, Figs. 1, 2.

(8) (?) *Euceratherium* (*Taurotragus*) *americanum* (Gidley)

From Cumberland Cave, Maryland

Taurotragus americanus GIDLEY, 1913, Smithson. Misc. Coll., LX, No. 27, p. 1, Pl. i, Fig. 2; 1914, *ibid.*, LXIII, No. 8, p. 16, Figs. 18, 19; 1920, Rept. Smithson. Inst. for 1918, p. 283. HAY, 1920, Proc. U. S. Nat. Mus., LVIII, p. 113, Pl. v, Figs. 7–11.
 "*Taurotragus*" *americanus* GIDLEY, GAZIN, 1933, Journ. Mamm., XIV, No. 2, p. 162.

TYPE.—Right maxillary den- N.M.7622 Figured by Gidley, 1913, Pl.
tition. i, Fig. 2.

REFERRED BY C. L. GAZIN, 1933.—

Ramal dentition.

(8a) (?) *Euceratherium americanum*, referred Gazin

From the Vicinity of Alton, Illinois

Taurotragus americanus GIDLEY, HAY, 1920, Proc. U. S. Nat. Mus., LVIII, p. 113.
Euceratherium (?) *americanum* (GIDLEY), GAZIN, 1933, Journ. Mamm., XIV, No. 2,
p. 163.

EXAMPLE.—Lower left molar. N.M.3987 Collected at Kimmswick,
Missouri, about 20 mi. S. of
St. Louis and 40 mi. S. of
Alton, Ill.

(Height of tooth 50 mm.; length 53 mm.; thickness at base of first lobe, 23
mm.; at base of second lobe, 24 mm.; at base of third lobe, 15 mm.)

(9) *Euceratherium collinum morrisi* Schultz and Howard

From New Mexico

Euceratherium collinum morrisi SCHULTZ AND HOWARD, 1935, Proc. Acad. Nat. Sci.
Phila., LXXXVII, p. 290, Pls. XIII, Figs. 3-4; XIV, Figs. 1-4, 10.

TYPE.—Posterior portion of A.N.S.P.13418 From Burnet Cave, New
skull with horn-cores. Mexico.
Figured by Schultz and How-
ard, 1935, Pls. XIII, Figs.
3-4; XIV, Figs. 1-4, 10.

DOUBTFULLY REFERRED SPECIMENS FROM TYPE LOCALITY.—

Palate with right m^1-m^2 A.N.S.P.13808
and left m^2-m^3 .

Left ramus with p_1-m_3 , A.N.S.P.13806
and right ramus with p_4-
 m_3 .

Metacarpal. A.N.S.P.13950

Astragalus. 13982

1st and 2d phalanges. 13423 and 13438

(9a) (?) *Euceratherium* (*Preptoceras*) *sinclairi neomexicana*
(Schultz and Howard)

From New Mexico

Preptoceras sinclairi neomexicana SCHULTZ AND HOWARD, 1935, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 291, Pl. XII, Figs. 2-3.

TYPE.—Left horn-core.

A.N.S.P.13807

From Burnet Cave, New Mexico.

Figured by Schultz and Howard, 1935, Pl. XII, Figs. 2-3.

(10) (?) *Euceratherium* (*Preptoceras*) cf. *sinclairi*, referred Freudenberg (1921)

From the Valley of Mexico

Preptoceras cf. *sinclairi* referred FREUDENBERG, 1921, Geologie von Mexiko, pp. 137, 139; 1922, Geol. Pal. Abh. Jena, XIV (XVIII), Heft. 3, p. 5.

Freudenberg merely cites as present.

Subfamily 3.—Ovinæ

VI. *OVIS* LINNÆUS

Figure 55A and (in part) 56

Genotypic species, *Ovis aries* Linnæus (1758)

Statement

Knowledge of the wild sheep of the North American Pleistocene has been limited mainly to a few cave finds. The general absence of the sheep and of the goat in sedimentary accumulations perhaps may be accounted for sufficiently by the mountainous habitat of both. The Alaska collection is of especial interest in including, besides partial crania of mountain sheep with horn-cores of *Ovis dalli* shape, a specimen of a much smaller form more nearly resembling *Ovis aries*.

The rather typical *O. dalli*-like crania are referred to a subspecies, *O. dalli kaiseni*, named in memory of Peter C. Kaisen, the leader of the two first Alaska College-American Museum expeditions of 1929 and 1930¹.

The domestic sheep, like the goat and the ox and unlike the horse, has been supposed to have been absent from the Western Hemisphere until introduced by the early voyagers from Europe. The second Alaskan form is much smaller than any Rocky Mountain sheep and lacks the characteristic prominence of the anterior orbital margin and the large and upright horn-cores of the latter. The specimen is remarkably suggestive of an average domestic ewe: in size, in tendency toward a similar depression postero-inward of the horn bases, and in the small, broadly flaring and downwardly curved horn-cores. The unique and curious find is referred to a distinct species, *Ovis dorshi*, after John B. Dorsh of Alaska College, leader of the Joint Alaska College-American Museum expeditions of 1933-1935.

Ten or more subspecies or races of the two species of Recent mountain sheep have been deemed worthy of recognition:

O. canadensis canadensis Shaw (1804), from Alberta to Arizona; *O. c. californiana* (Douglas) (1829), from California to Washington; *O. c. sierræ* (Grinnell) (1912), from the Sierras; *O. c. gaillardi* Mearns (1907), from Sonora and southwestern Arizona; *O. c. nelsoni* (Merriam) (1897), from Nevada to Lower California; *O. c. auduboni* Merriam (1901), from the Badlands; *O. c. texiana* Bailey (1912), from Texas and New Mexico; *O. dalli dalli* (Nelson) (1884), from Alaska and the Yukon; *O. d. fannini* (Hornaday) (1901), from the Yukon; *O. d. stonei* (Allen) (1897), from northern British Columbia (see figured head, Fig. 55A). (After H. E. Anthony, 1928.)

An extinct species, *O. mamillaris* Hildreth (1837), has been based on a skull from Ohio. The two here recognized forms from the Quaternary of Alaska are:

(1) *Ovis dalli kaiseni*, new subspecies

TYPE.—Nearly complete skull. A.C.-F:A.M.30700 1930.

REFERRED.—Three partial A.C.-F:A.M. Coll. 1930 and 1934.
crania.

(2) *Ovis dorshi*, new species

TYPE.—Posterior half of cranium with horn-cores. A.C.-F:A.M.30701 1931.

This paper, Fig. 56.

¹ The investigation in 1931 was continued by Doctor Albert S. Wilkerson of Alaska College, and in 1932 by Professor Ray Henriksen, assisted by Wilson Walton.

Subfamily 4.—**Ovibovinae**VII. **OVIPOS** BLAINVILLEVIII. **SYMBOS** OSGOODIX. **BOÖTHERIUM** LEIDY

Figure 55D, F

Statement

The existing genus *Ovibos* Blainville and the extinct genera *Symbos* Osgood and *Boötherium* Leidy seem to have been widely distributed in North America during the Quaternary. Remains are referred to *Ovibos* from the prehistoric deposits of France, as well as from the Quaternary of Asia. While Ovibovinae so far are unreported from Rancho La Brea, California, all three genera are represented in the collections from Fairbanks, Alaska. As seen in these remains, there is no longer cause for question as to the presence of distinct cranial characters in *Symbos* as compared to *Ovibos*. Definite knowledge yet seems to be lacking as to in what degree the tooth characters of *Symbos* differ from *Ovibos* and *Boötherium*.

A splendid specimen of *Symbos* from Fairbanks shows the hitherto unrecognized elongation of the nasals and muzzle, and permits a recharacterization of the genus. As compared to *Ovibos*, *Symbos* is larger, the nasals are much longer proportioned, the occiput is higher, the condyles are larger and the orbits are lower and more posteriorly placed. The basal horn-core plate is thicker dorsoventrally, longer-proportioned anteroposteriorly, and medianly undivided and deeply excavated as compared to *Ovibos*. In *Symbos*, while the greatest over-orbital breadth of the cranium is 48% of the distance from the anterior nasals to the inion, versus 65% in *Ovibos*, the nasals equal 94% of the distance from the anterior border of the frontals to the inion, versus 58% in *Ovibos*. The horns of the genus *Boötherium* are at once distinguishable from those of the two preceding genera by the absence of the basal plate and their marked relative slenderness and outward direction. A giant Ovibovine species, indicated by a humerus from Fairbanks, recalls certain huge Ovibovine remains from the Quaternary of Idaho, once shown to the writer by James W. Gidley.

The Alaska Quaternary has yielded remains of four different musk-oxen: *Ovibos yukonensis* Gidley, (?) *Ovibos giganteus*, new species, *Sym-*

bos tyrrelli Osgood and *Boötherium nivicolens* Hay. The Alaskan *O. yukonensis* remains were originally referred directly to the Recent *O. moschatus*. *S. tyrrelli* Osgood seems to resemble *S. cavifrons* (Leidy) from Indian Territory. *B. nivicolens* Hay is said to resemble both *B. bombifrons* (Harlan) from Kentucky and *B. sargenti* Gidley from Michigan.

The three genera, VII, *Ovibos* Blainville, VIII, *Symbos* Osgood and IX, *Boötherium* Leidy, and their species, types and referred remains, as recorded in the literature or newly encountered in Alaska, are summarized in the following pages.

Summary of Named American Species

VII. *Ovibos*¹ Blainville.

- (1) *Ovibos moschatus* (Zimmerman), genotypic species, Recent and fossil.

- (2) *Ovibos appalachicolus* Rhoads, from Durham Cave, Pennsylvania.

TYPE.—Horn-core base, A.N.S.P.29.

- (3) (?) *Ovibos zuniensis* (Gidley), from New Mexico.

TYPE.—Top and back portion of skull and horn-cores, N.M.5100.

- (4) *Ovibos yukonensis* Gidley, from the Palisades of the Yukon, Alaska.

TYPE.—Nearly complete skull, N.M.5728.

- (4a) *Ovibos proximus* Bensley, from Ontario, Canada.

TYPE.—Brain case, horn-cores and portion of skull, Royal Ontario Mus. Coll.

- (5) (?) *Ovibos giganteus*, n.sp., from the Fairbanks area, Alaska.

TYPE.—Humerus, A.C.-F:A.M.30498.

¹ An extinct form is indefinitely reported by Rüttimeyer (1865, Verh. Nat. Gesellsch. Basel, IV, p. 328), *Ovibos fossilis*; and a skull and other remains from northern Russia have been referred to the same by Pavlow (1906, Mém. Acad. Imp. Sci. St. Pétersbourg [8], XXI, No. 1, p. 28, Pls. II and III [in part]).

VIII. *Symbos* Osgood.

- (1)
- Symbos cavifrons*
- (Leidy), from Indian Territory.

TYPE.—Cranium, A.N.S.P. Coll.

- (1a-e)
- Symbos cavifrons*
- vars., from Iowa, Indiana, Nebraska, Illinois and Missouri; and (1cc)
- S. convexifrons*
- Barbour, from Nebraska.

EXAMPLES.—Skulls and partial crania—see details following.

- (2)
- Symbos tyrrelli*
- Osgood, genotypic species, from Yukon Territory.

GENOTYPE.—Skull, N.M.2555.

IX. *Boötherium* Leidy.

- (1)
- Boötherium bombifrons*
- (Harlan), genotypic species, from Big Bone Lick, Kentucky.

GENOTYPE.—Partial skull and horn-cores, A.N.S.P. Coll.

- (1a) (?)
- Boötherium bombifrons*
- , var., from "Frankstown Cave," Pennsylvania.

EXAMPLE.—Fragmentary remains, C.M.11036.

- (1b)
- Boötherium bombifrons*
- , var., from (?) Douglas County, Nebraska.

EXAMPLE.—Fragmentary skull portion, N.S.M.193-25-5-27.

- (2)
- Boötherium sargenti*
- Gidley, from Grand Rapids, Michigan.

TYPE.—Upper portion of skull, Kent Scientific Mus. Coll.

- (3)
- Boötherium nivicolens*
- Hay, from Alaska.

TYPE.—Top of cranium with horn-cores, N.M.2324.

Detailed Lists of Types, Referred Specimens, and Synonymy

VII. *OVIPOS BLAINVILLE*

Reconstruction, Figure 55f

Remains from Pennsylvania, New Mexico, Ontario and Alaska have been made the types of as many extinct species, and specimens from other Quaternary localities have been referred to the living species. The six forms currently recognized are:

(1) *Ovibos moschatus* (Zimmerman), genotypic species

Quaternary remains referred to the living species have been reported from New Jersey, Pennsylvania, Ohio, Indiana, Iowa, Nebraska, Minnesota, South Dakota, Colorado, Oklahoma, Ontario, Alberta and Alaska. The three Recent North American species and subspecies are: *Ovibos moschatus wardi* Lydekker (1900), from Greenland *O. m. niphæcus* Elliot (1905), from Wager Inlet, Northwest Territory, Canada; and *O. m. moschatus* (Zimmerman) (1870), from Barren Ground and west of Hudson Bay—evidently the type area.

A skull (N.M.14413) of the Recent species is figured by Osgood (1905, Pl. xxxvii, Fig. 1; Pl. xxxviii, Fig. 1; Pl. xxxix, Fig. 3) under *Ovibos moschatus*. According to C. L. Gazin (communicated), the skull together with the rest of the skeleton was collected by W. L. Hardesty in 1873 or 1874, east of the mouth of the Mackenzie River.

(2) *Ovibos appalachicolus* Rhoads

From Pennsylvania

Bison appalachicolus RHOADS, 1895, Proc. Acad. Nat. Sci. Phila., XLVII, p. 248.

Ovibos appalachicolus RHOADS, 1897, *ibid.*, XLIX, p. 492; 1903, Fossil Mammals of Pennsylvania and New Jersey, p. 239. HAY, 1923, Carn. Inst. Wash. Pub. 322, p. 249.

TYPE.—Horn-core base.

A.N.S.P.29

From Durham Cave, near Riegelsville, Bucks County, Pennsylvania.

Frankstown Cave (?) *Boötherium bombifrons*, var., referred remains may represent the above species. (See Peterson, 1926.)

(3) (?) *Ovibos zuniensis* (Gidley)

From New Mexico

Liops zuniensis GIDLEY, 1906, Proc. U. S. Nat. Mus., XXX, p. 165, Figs. 1-3.*Gidleya zuniensis* COSSMANN, 1907, Rev. Crit. Paléozool., XI, p. 64.

TYPE.—Top and back portion of skull and horn-cores. N.M.5100 From $4\frac{1}{2}$ mi. E. of Zuni, New Mexico.
Figured by Gidley, 1906, Figs. 1-3.

(Horn-cores said to be relatively longer, less robust, and less drooping than in *Ovibos* and *Symbos*, and foramen magnum confined entirely to occipital base of skull.)

(4) *Ovibos yukonensis* Gidley¹

From the Palisades of the Yukon, Alaska

Ovibos moschatus (?) (ZIMMERMAN), referred GILMORE, 1908, Smithson. Misc. Coll., LI, No. 1807, p. 35.*Ovibos yukonensis* GIDLEY, 1908, Proc. U. S. Nat. Mus., XXXIV, No. 1627, p. 681, Pls. LVII-LVIII and Text-Fig.

TYPE.—Nearly complete skull with m^2 - m^3 . (w) N.M.5728 Collected by Gilmore in 1907 from Palisades of the Yukon.
Figured by Gidley, 1908, Pls. LVII-LVIII and Text-Fig.

REFERRED.—

Four crania or partial crania. A.C.-F.A.M. Coll. From the Fairbanks area, 1929-33.

(4a) *Ovibos proximus* Bensley

From the Late Pleistocene, Ontario, Canada

Ovibos proximus BENSLEY, 1923, Univ. Toronto Studies, Biol. Ser., No. 23, p. 1, Pls. I, II.

TYPE.—Brain case, horn-cores and nasofrontal portion of skull. Royal Ontario Mus. Coll. From Iroquois Beach Deposits, Ontario.
Figured by Bensley, 1923, Pls. I, II.

¹ Possibly of the same form, but indeterminate:*Ovibos maximus* RICHARDSON, 1852-1854, Zoology of the Voyage of H. M. S. Herald, p. 25, Pl. XI, Figs. 2-4.*Ovibos* ? indet. GILMORE, 1908, Smithson. Misc. Coll., LI, No. 1807, p. 38.

TYPE.—Partial cervical. Haslar Mus. Coll. From Eschscholtz Bay, Alaska.

(5) (?) *Ovibos giganteus*, new species

From the Fairbanks Area, Alaska

A giant Ovibovine species is indicated by a humerus from Fairbanks, secured by the Joint Alaska College-American Museum of Natural History Expedition. The specimen is made the type of a new species, tentatively allocated to the genus *Ovibos*. Determination of the affinity of this great Alaskan species and the giant Idaho form secured by James W. Gidley in 1930 would be of high interest.

TYPE.—Humerus.

A.C.-F.A.M.30498 From Fairbanks area, Alaska.

Length 390 mm., versus National Museum specimen from Idaho, estimated 470 mm., versus Recent *O. moschatus* referred, from Greenland [A.M.(M.) 100058], 250 mm.

VIII. *SYMBOS* Osgood

Specimens have been referred to the extinct species, *S. cavifrons* (Leidy), from the Pleistocene of Indian Territory, Iowa, Indiana, Nebraska, Illinois, Missouri, Ohio, West Virginia and Pennsylvania. Remains from Alaska are placed in a distinct species, *Symbos tyrrelli* Osgood. *S. tyrrelli* may represent the female of *S. cavifrons*. [Lydekker (1898) and others considered *S. cavifrons* to represent a male of *B. bombifrons*.] The genus is recharacterized on a preceding page. The two species and several variations are:

(1) *Symbos cavifrons* (Leidy)

From Indian Territory

Ovibos cavifrons (HARLAN), LEIDY, 1852, Proc. Acad. Nat. Sci. Phila., VI, p. 71.

Bootherium cavifrons LEIDY, 1852, Smithson. Contrib. Knowl., V, Art. 3, pp. 12-17, Pl. III, Figs. 1, 2; Pl. IV, Fig. 1.

Ovibos priscus RÜTIMAYER (in part), 1865, Verh. Nat. Gesellsch. Basel, IV, p. 328.

(Proposed to include both *O. bombifrons* and *O. cavifrons*.)

Scaphoceros cavifrons (LEIDY), OSGOOD, 1905, Smithson. Misc. Coll., XLVIII, No. 1589, p. 181, Pl. XL, Fig. 1; Pl. XLI, Fig. 1; Pl. XLII, Fig. 1.

Symbos cavifrons (LEIDY), OSGOOD, 1905, Proc. Biol. Soc. Wash., XVIII, p. 223.

HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 298, Pl. xxxvi, Fig. 4 (after Osgood).

TYPE.—Cranium.

A.N.S.P. Coll.

From near Fort Gibson, Indian Territory.

Figured by Leidy, 1852, Pl. III, Figs. 1, 2; Pl. IV, Fig. 1; by Osgood, 1905, Pl. XL, Fig. 1; Pl. XLI, Fig. 1; Pl. XLII, Fig. 1; by Hay, 1914, Pl. XXXVI, Fig. 4.

(1a) *Symbos cavifrons*, Var.

From Iowa

Oribos cavifrons LEIDY, MCGEE, 1887, Amer. Journ. Sci. (3), XXXIV, p. 217.

Symbos cavifrons (LEIDY), HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, pp. 42, 305, Pl. XXXVII, Fig. 3.

? *Symbos cavifrons* (LEIDY), HAY, 1930, Journ. Wash. Acad. Sci., XX, No. 21, p. 501.

EXAMPLE.—Skull.

Univ. Iowa 107

From the loess of the Missouri River at Council Bluffs, Iowa.

Figured by Hay, 1914, Pl. XXXVII, Fig. 3 (photograph of skull).

(1b) *Symbos cavifrons*, Var.

From Hebron, Indiana

Symbos cavifrons (LEIDY), HAY, 1912, Ann. Rept. for 1911, Dept. Geol. Nat. Res. Indiana, XXXVI, p. 635, Text-Figs. 49, 50. ALLEN, 1913, Mem. Amer. Mus. Nat. Hist. (n.s.), I, Pt. IV, pp. 169, 214, Text-Fig. 25, Pls. XVII, XVIII. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 298, Figs. 98, 99.

EXAMPLE.—Skull.

A.M.14369

Figured by Hay, 1912, Text-Figs. 49, 50; 1914, Figs. 98, 99; by Allen, 1913, Text-Fig. 25, Pls. XVII, XVIII [i.e., A.M.14365].

(1c) *Symbos cavifrons*, Var., and (1cc) *S. convexifrons* Barbour

From Nebraska

Symbos cavifrons (LEIDY), BARBOUR, 1931, Bull. Nebr. State Mus., I, No. 25, p. 216, Figs. 139-144.

S. cavifrons, var., BARBOUR, 1931:

EXAMPLED.—Six partial crania.	N.S.M.31-12-91, 4-10-95, 15-11-00, 20-10-04, 22-11-30, 4-10-30 [cast]	Respectively from an indefinite locality; Cambridge, Furnas County; Endicott, Jefferson County; Otoe County; Gage County; Spring Ranch, Clay County. Figured by Barbour, 1931, Figs. 139-144.
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S. convexifrons BARBOUR, 1934 (Bull. Nebr. State Mus., I, No. 37, p. 295, Figs. 173, 174):

TYPE.—Right horn-core, etc. (Not included in count.)	N.S.M.1-2-34	From Cherry County. Figured by Barbour, 1934, Figs. 173, 174.
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(1d) *Symbos cavifrons*, Var.

From Illinois

Symbos promptus ? HAY, 1921, Proc. U. S. Nat. Mus., LVIII, p. 115; 1923, Carn. Inst. Wash. Pub. 322, p. 254.

Symbos cavifrons (LEIDY), HAY, 1923, Carn. Inst. Wash. Pub. 322, pp. 104, 253.

EXAMPLE.—Posterior cranium.	N.M.7800	From Manito, Mason County, Illinois.
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(Said to be possibly of a cow.) Tip to tip of horn-cores = 437 mm., versus 525 mm. of Hebron specimen.

REFERRED BY HAY TO *Symbos promptus* ?.—

?Lower left second molar. (Crown is 34 mm. long, 25 mm. wide at base.)	N.M.9011	From Alton, Madison County, Illinois.
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(1e) *Symbos cavifrons*, Var.

From Missouri

*Bos pallasii*¹ DEKAY, 1828, Ann. Lyc. Nat. Hist. N. Y., II, p. 291; 1842, Zoology of New York, Pt. I, p. 110. OSGOOD, 1905, Smithsonian. Misc. Coll., XLVIII, No. 1589, p. 180.

EXAMPLE.—Fragment of cranium.	From New Madrid, Missouri.
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¹ Osgood (1905, p. 180) observes that "*Bos pallasii* was based on the same specimens as *Bos pallantis* and is therefore a synonym. It is, moreover, preoccupied by *Bos pallasii* Baer 1823, proposed for a different animal. In the same paper in which Dekay proposed the name *pallasii*, he described a specimen from New Madrid, Missouri, which evidently belongs to the species later called *cavifrons* by Leidy."

(2) *Symbos tyrrelli* Osgood, genotypic species

From Yukon Territory

Scaphoceros tyrrelli Osgood, 1905, *Smithson. Misc. Coll.*, XLVIII, No. 1589, p. 174, Pl. xxxvii, Fig. 2; Pl. xxxviii, Fig. 2; Pl. xxxix, Fig. 1; Pl. xl, Fig. 2.

Symbos tyrrelli Osgood, 1905, *Proc. Biol. Soc. Wash.*, XVIII, p. 223. Referred GILMORE, 1908, *Smithson. Misc. Coll.*, LI, No. 1807, p. 34. GIDLEY, 1908, *Proc. U. S. Nat. Mus.*, XXXIV, No. 1627, p. 682. HAY, 1914, *Ann. Rept. for 1912, Iowa Geol. Surv.*, XXIII, p. 298, Pl. xxxvii, Figs. 1, 2.

GENOTYPE.—Skull, well preserved, with much worn teeth.

N.M.2555

From Bonanza Creek, Yukon Territory.

Figured by Osgood, 1905, Pl. xxxvii, Fig. 2; Pl. xxxviii, Fig. 2; Pl. xxxix, Fig. 1; Pl. xl, Fig. 2; by Hay, 1914, Pl. xxxvii, Figs. 1, 2.

REFERRED.—

Posterior portion of skull and one attached horn-core.

N.M. Coll.

Secured with type from Bonanza Creek by J. B. Tyrrell.

Horn-core.

N.M.2378

From near Anvik, Yukon River, Alaska. Dr. Arthur Hollick, Collector.

REFERRED FROM FAIRBANKS, COLLECTED BY THE JOINT ALASKA COLLEGE-AMERICAN MUSEUM EXPEDITION.—

A fine partial skull with nasals preserved, dentition lacking.

A.C.-F:A.M.30501 1934.

Twelve crania.

A.C.-F:A.M. Coll. 1930-34.

Left mandibular ramus with p_2 - m_3 . (w)

A.C.-F:A.M.30502 1931.

Allocated to this genus, which includes the majority of the Alaskan finds, because of p_3 with closed anterior fossette (versus open in Recent *Oribos*).

Postsymphysial distance = 78 mm., p_2 - m_3 = 175, p_2 = 16, p_3 = 23, p_4 = 26.

IX. BOOTHERIUM LEIDY

Reconstruction, Figure 55d

Three species have been described from the Pleistocene: *B. bombi-*

frons (Harlan), genotypic species, from Kentucky; *B. sargenti* Gidley, from Michigan; and *B. nivicolens* Hay, from Alaska. Questioned remains from Pennsylvania and from Nebraska have been referred to *B. bombifrons*. Additional evidence as to the genus is afforded by the newly secured Alaskan specimens.

(1) **Boötherium bombifrons** (Harlan), genotypic species

From Big Bone Lick, Kentucky

"... nearly allied to the bison?" WISTAR, 1818, Trans. Amer. Phil. Soc. (n.s.), I, p. 379, Pl. xi, Figs. 10, 11.

Bos bombifrons HARLAN, 1825, Fauna Americana, p. 271.

Ovibos bombifrons (HARLAN), LEIDY, 1852, Proc. Acad. Nat. Sci. Phila., VI, p. 71.

Boötherium bombifrons (HARLAN), LEIDY, 1852, Smithson. Contrib. Knowl., V, Art 3, p. 17, Pl. iv, Fig. 2; Pl. v, Figs. 1, 2. OSGOOD, 1905, Smithson. Misc. Coll., XLVIII, No. 1589, p. 181, Pl. xxxix, Fig. 2; Pl. xli, Fig. 2; Pl. xlii, Fig. 2. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 291, Pl. xxxv, Figs. 1, 2.

Ovibos priscus RÜTIMEYER (in part), 1865, Verh. Nat. Gesellsch. Basel, IV, p. 328.

(Proposed to include both *O. bombifrons* and *O. cavifrons*.)

GENOTYPE.—Partial skull and horn-cores.	A.N.S.P. Coll. Collected for President Jefferson by General Clark	Figured by Wistar, 1818, Pl. xi, Figs. 10, 11; by Leidy, 1852, Pl. iv, Fig. 2; Pl. v, Figs. 1, 2; by Osgood, 1905, Pl. xxxix, Fig. 2; Pl. xli, Fig. 2; Pl. xlii, Fig. 2; by Hay, 1914, Pl. xxxv, Figs. 1, 2.
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(1a) (?) **Boötherium bombifrons**, Var.

From "Frankstown Cave," Pennsylvania

Boötherium bombifrons (HARLAN), PETERSON, 1926, Ann. Carn. Mus., XVI, No. 2, p. 258, Pl. xix, Figs. 1-13; Pl. xx, Figs. 1-8; and Pl. xxi.

EXAMPLE.—Fragmentary remains of possibly three individuals.	C.M.11036,a,b	From Frankstown Cave, Pennsylvania. Figured by Peterson, 1926, Pl. xix, Figs. 1-13; Pl. xx, Figs. 1-8 (11036); and Pl. xxi (11036b).
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(C.M.11036 said to be most completely preserved.)

Frankstown Cave remains possibly are of the same species as those of Durham Cave (see *Ovibos appalachicolus* Rhoads, page 559).

(1b) **Boötherium bombifrons**, Var.

From Nebraska

Bootherium sp. indt. BARBOUR, 1931, Bull. Nebr. State Mus., I, No. 25, p. 227, Fig. 146.

EXAMPLE.—Single fragmen- N.S.M.193-25-5-27 From (?) Douglas County, Ne-
tary skull portion. braska.
Figured by Barbour, 1931,
Fig. 146.

(2) **Boötherium sargenti** Gidley

From Grand Rapids, Michigan

Boötherium sargenti GIDLEY, 1908, Proc. U. S. Nat. Mus., XXXIV, No. 1627, p. 683,
Pl. LIX.

TYPE.—Upper portion of skull Kent Scientific Figured by Gidley, 1908, Pl.
with horn-cores. Mus. Coll. LIX.

(Two-thirds the size of Recent muskox and somewhat larger than type of *B. bombifrons*, according to Gidley.)

(3) **Boötherium nivicolens** Hay

From Alaska

Boötherium nivicolens HAY, 1915, Proc. U. S. Nat. Mus., XLVIII, p. 523, Pl. xxxi.

TYPE.—Top of cranium with N.M.2324 From Eschscholtz Bay.
horn-cores. Figured by Hay, 1915, Pl.
xxxI.

REFERRED SPECIMENS FROM THE FAIRBANKS AREA, SECURED BY THE ALASKA COL-
LEGE-AMERICAN MUSEUM EXPEDITION.—

Cranium with horn-cores. A.C.-F:A.M.30500 1930.

Partial cranium with stub A.C.-F:A.M.30499 1934.
of right horn-core.

Cranium with horn-cores A.C.-F:A.M.30508 1935.
and apparently associated tips of horn-sheaths of heavy proportions.

DIVISION C.—BOVINI

Subfamily 5.—Bovinae

X. BOS LINNÆUS

XI. BISON H. SMITH

XII. SUPERBISON NOBIS

Figures 57, 58

Statement

Unfortunately, so far nothing is definitely known as to the American Tertiary forerunners of the far-flung Bovines of Quaternary time, those vast herds that stretched across the northern areas of both hemispheres—the British Isles, northern Europe,¹ Asia and America. That in the history of the known forms many species were involved, and that there was a mingling from time to time of remote races and strains, well may be believed. The genus *Bison* appears suddenly and widespread in the Pleistocene accumulations of America. Recent explorations in the vicinity of Fairbanks, Alaska, indicate the apparent presence of a contemporary second and more yak-like form in the local Pleistocene. Though there is some question as to the age of the cranial specimens the evidence, such as it is, is extremely interesting in affording the first intimation of the occurrence of *Bos* (*Poëphagus*) on this continent. The type and referred specimens were secured in the summer of 1934 by John B. Dorsh of the Joint Alaska College-American Museum Expedition. The material is referred to a new species, *Bos bunnelli*, named in honor of Charles E. Bunnell, President of Alaska University.

The *Bison* remains from the North American Quaternary for convenience may be divided on the character of the size of the horn-cores between *Bison* proper, in which the cores are of moderate dimensions, and the subgenus *Superbison*, in which they may greatly exceed in size those of Recent species. *Superbison* was originally employed by the writer (1930) for the form from the Alaskan Quaternary. *Superbison* and *Bison* are both represented in fossil remains from Kentucky, Ohio, Nebraska, Kansas and Texas. *Superbison* alone is recognized in the col-

¹ *Superbison latifrons* is partially suggested in remains from northern Russia figured under *B. priacus* by Pavlow (1906, Pl. iv, Figs. 5 and 5a), and from England, figured under *B. bonasus* by Lucas (1899, Pl. LXXI).

lections from Alaska, Idaho and Arizona, and *Bison* only from Indiana, Iowa, New Mexico, California and Oregon. A skull from the Texas Pleistocene, of shorter proportions than the ordinary, has been made the type of a third subgenus, *Simobison* Hay and Cook (1930). *Stelabison* Figgins (1933) has been proposed for certain Nebraskan forms which exhibit well-defined columns on the outer sides of the upper molars. Some twelve of the types of the twenty-one heretofore named Quaternary species and subspecies consist of horn-cores or partial horn-cores, the associated dentitions being unknown. As yet there seems to be no record of a Recent-sized *Bison* horn-core having been found in definite association with *Superbison* remains. In the several cases where evidence exists as to man's association with extinct *Bison* species, according to C. Bertrand Schultz, the remains are of the smaller *Bison*, evidence as yet being lacking as to the contemporaneity of man and *Superbison*. The pre-Pleistocene occurrences reported by Matthew and Cook (1909) of *Bison* species in the "Nebraska Tertiary," and by Marsh (1877) of the types of *B. alleni* and *B. ferox* in the "Lower Pliocene," were probably in error. The remains were evidently from the Pleistocene. For the purpose of a preliminary survey of the named species and convenience in future study, the so-far-listed Quaternary forms are divided below according to size between the genus and the larger *Superbison*, and grouped according to occurrence: (a) East, (b) West of the Mississippi and (c) Alaska. A careful reëxamination of the named types, in the light of the more lately amassed Fairbanks evidence, is greatly to be desired.

In the following pages, *Bos bunnelli*, n.sp., is described and the twenty-odd named species of the American Quaternary *Superbison* and *Bison* are listed, together with the types and referred remains.

X. BOS LINNÆUS¹

(1) *Bos* (*Poëphagus*)² *bunnelli*, new species

From the Fairbanks Area, Alaska

Figure (in part) 58

Marked interest is attached to the discovery in the Pleistocene of

¹ *Bos* Linnæus (1758, Syst. Nat. [10], I, p. 71; 1766, *ibid.* [12], I, p. 98), *Bos taurus* Linnæus (type), from Poland; *B. bonasus* Linnæus, from Europe; and *B. bison* Linnæus, from western United States.

² The Asiatic yak, *Bos grunniens* Linnæus (1766, Syst. Nat. [12], I, p. 99), was referred to the genus *Poëphagus* by Gray (1843, List Mamm. Brit. Mus., p. 39).

Alaska of a Bovine that differed from the bison much as do the gaur and yak. The new ox is represented in the Fairbanks collection by the anterior two-thirds of a cranium and a number of maxillary and ramal dentitions. While the skull, so far as observable, resembles the banting and gaur versus the bison, the characters seem even more like those of the yak than either of the last. (Nothing actually as yet is known of the prehistory of the yak.) The orbits are placed relatively forward and are far less protruding or tube-like, the nasals were apparently proportionately narrower, and were in near contact with the vertical wings of the premaxillæ, the incisive border was more flared, the unworn tooth crowns notably narrower and taller, the premolar pattern different and the premolar bases more compressed anteroposteriorly than in the bison. The horn-cores and occiput are unfortunately missing. A very tentatively referred metapodial is long and ox-like compared to the short and heavy metapodials of both bison and yak. Recognition of the presence of this non-bison form in Alaska suggests that a near ally, or allies, of the same may be represented amid certain of the remains from deposits of the Great Plains now allocated to the bison. Since the above was written, a partial cranium with horn-cores (A.C.-F:A.M.30507) has been discovered by John B. Dorsh and his assistants, Archibald Roosevelt Jr. and Walter Sullivan.¹

TYPE.—Anterior two-thirds of skull with orbits, maxilla, premaxilla and palate completely preserved, p^2 alveolus and p^3-m^2 . (M+)

A.C.-F:A.M.30659 From Fairbanks area, Alaska, 1934.

REFERRED FROM FAIRBANKS AREA.—

Posterior portion of cranium with horn-cores suggestive of Recent yak. A.C.-F:A.M.30507 1935.

Palate with dentition. A.C.-F:A.M.30660 1934.

Three partial mandibles with dentitions. A.C.-F:A.M.30657, 1929, 1932.
30658 and 30662 This paper, *Fig. 58* (A.C.-F:A.M.30658).

And a number of detached teeth.

The smallest m_3 approximates (35.5) mm., and the largest m_3 (43.5) mm. in length.

¹ A reconsideration of the evidence in the light of newer finds, raises question as to the occurrence of certain of the yak-like specimens and suggests that these may be of more recent origin than the typical fossils of the Alaskan Pleistocene.

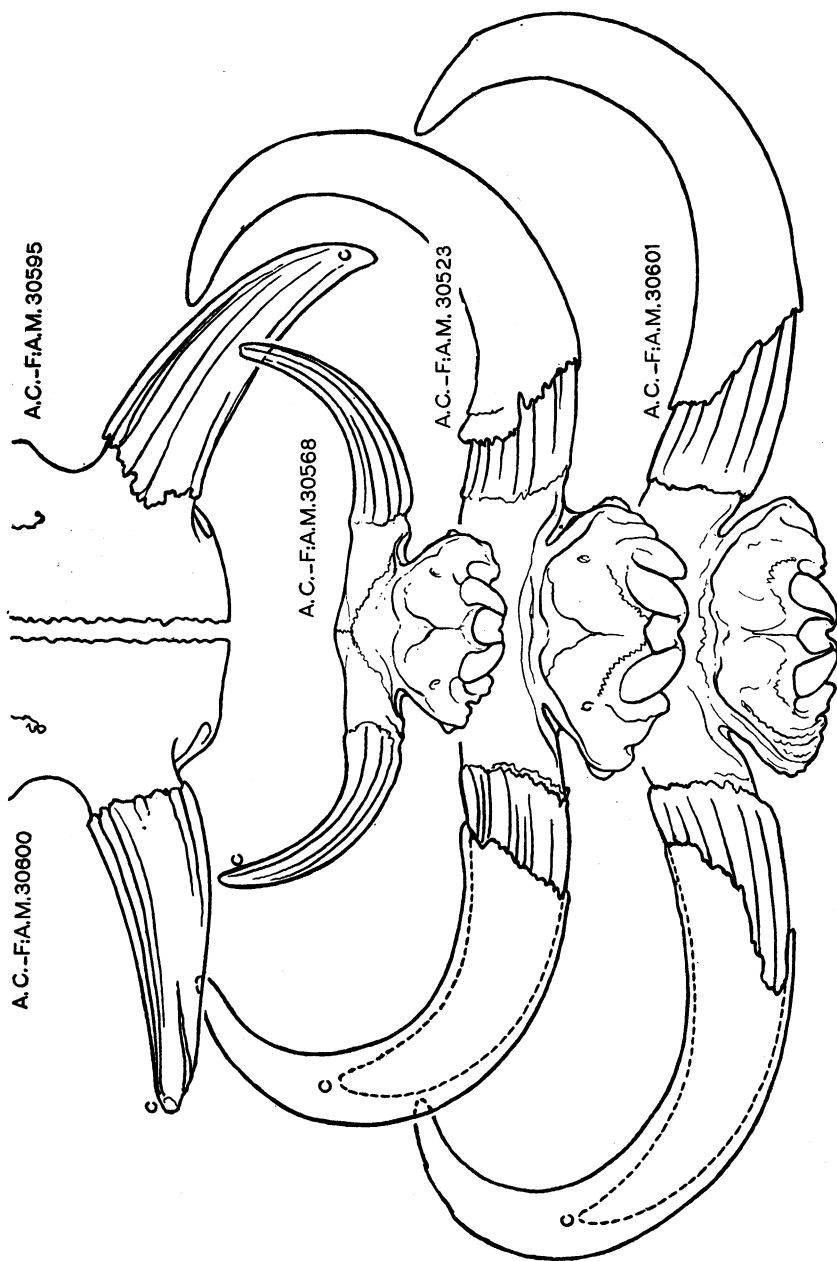


FIG. 57. *Superbison crassicornis* (Richardson), ref., from the Pleistocene of Alaska; dorsal views of A.C.-F.A.M. 30600, horn-core at right angles, and 30595, backwardly directed; occipital views of A.C.-F.A.M. 30568 (female), and 30523 and 30601 (large males) with horn-sheaths.

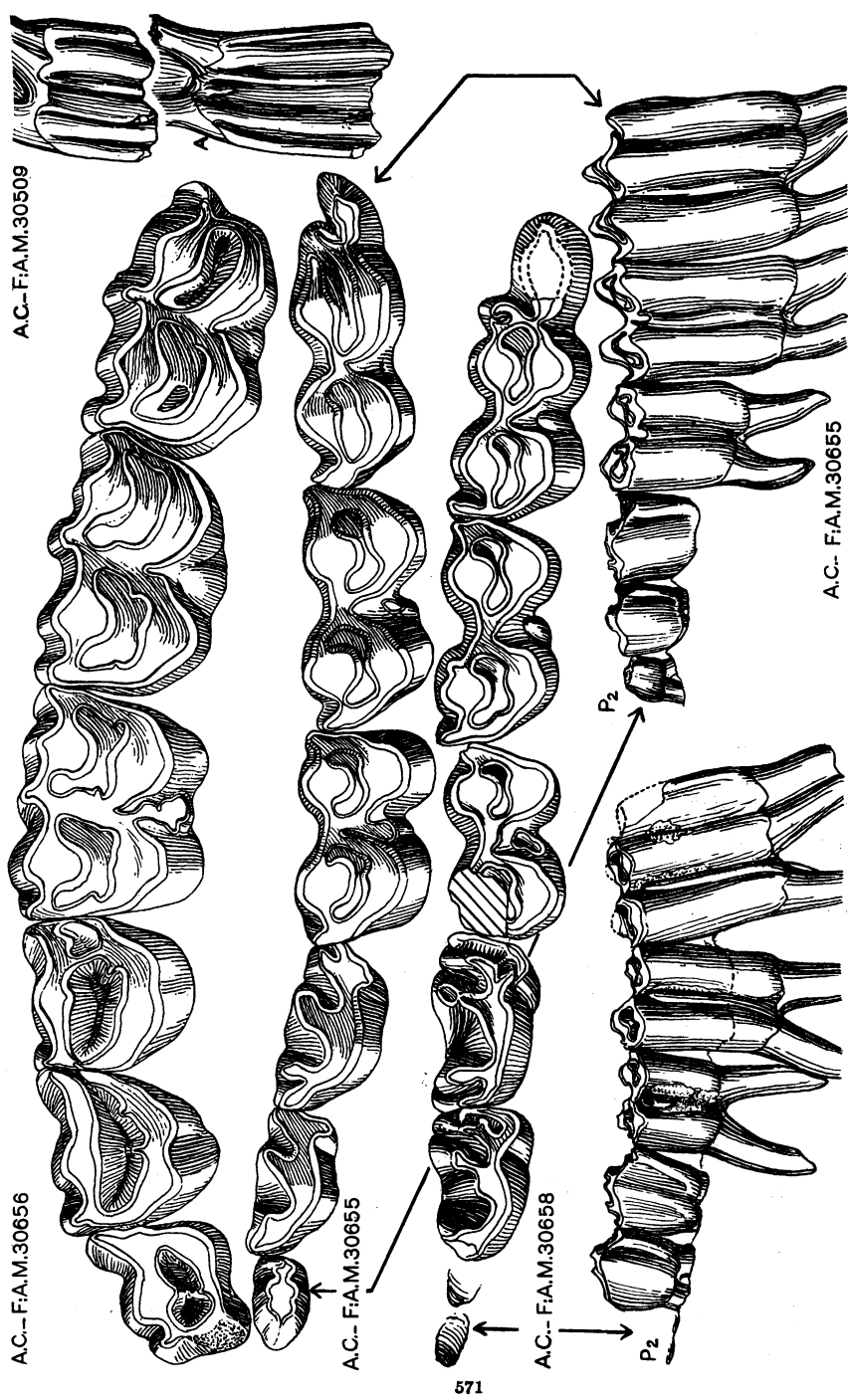


FIG. 58. *Superbison crassicornis* (Richardson), ref. (A.C.-F.A.M.30656, 30655, 30509 and A), and *Bos bunnelli*, n.sp., ref. (A.C.-F.A.M.30658, m₃ from 30657), from the Pleistocene of Alaska, maxillary and mandibular dentitions compared. Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. A with external style. (See pages 590, 599.)

XI, BISON H. SMITH AND XII, SUPERBISON NOBIS

Figures 57 and (in part) 58

Joel A. Allen (1876), in "The American Bisons, Living and Extinct," recognized three species: the living bison, *B. americanus* Catesby (1754), and two fossil species from Big Bone Lick, Kentucky, *B. latifrons* (Harlan, 1825) and *B. antiquus* Leidy (1852). Allen records the three earliest descriptions of fossil bison remains as: first, the part of a cranium of the gigantic form described by Peale (1803) from Kentucky [later *B. latifrons* (Harlan)]; second, the greater portion of a skull, etc., from Brazos River, Texas, described by Carpenter (1846) [*S. chaneyi* (Cook)]; and third, the molar teeth discussed by Leidy (1852) from Natchez, Mississippi (*Bison* sp.). Frederick A. Lucas (1899) recognizes six extinct American species: *B. occidentalis* Lucas and *B. crassicornis* Richardson, based on Alaskan remains; *B. antiquus* Leidy and *B. latifrons* (Harlan), types from Kentucky; *B. alleni* Marsh, type from Kansas; and *B. ferox* Marsh, type from Nebraska. The more recent researches of Hay, Cook, Figgins and others bring the number of described species and subspecies of extinct *Bison* from the United States to twenty. C. B. Schultz (1934) observes that the bison evidence from Nebraska alone is allotted currently to eight different species: *B. ferox* Marsh, type; *B. alleni* Marsh, referred; *B. antiquus* Leidy, referred; *B. occidentalis* Lucas, referred; *B. latifrons* (Harlan), referred; *B. regius* Hay, referred; *B. angularis* Figgins, type; and *B. rotundus* Figgins, type. Allen (1876) discusses and illustrates variation of skull form occurring in the Recent bison of North America, and Leidy (1869) even considers the Kentucky types of *B. latifrons* and the much smaller *B. antiquus* as representing the male and female of the same species. The fine series of bison crania and partial crania from the Fairbanks district is interpreted here as representing one widely varying Alaskan species. If this interpretation is correct, a fully commensurate variation would be expected in the different species dwelling to the south.

The Alaskan bison exhibit wide differences in the horn-cores and more moderate differences in the teeth. The Fairbanks series includes one hundred and fifty crania and partial crania and nearly two hundred mandibular rami and partial rami. (Six crania are nearly complete and three of these retain the dentitions.) As the gaps between the extreme forms in the case of the Fairbanks remains, both in the horns and teeth, are fairly well filled in by specimens of intermediate character, it seems unnecessary to believe that the same represent more than one

widely varying species. Several of the more marked Alaskan horn shapes are reminiscent of those of named species from more southern localities. The smaller of the Alaskan mature horn-cores (spread of 780 mm.) are fully as large or larger than the type of *B. antiquus* Leidy and the average of the remains from Folsom, New Mexico, and Rancho La Brea, California. The largest of the Alaskan cores is smaller than the types of *B. latifrons* Leidy, *B. chaneyi* and the more magnificent *B. regius*. The horn-cores of the *B. chaneyi* type are notably heavier in section and longer through the recurving of the tips (versus non-curved in the Alaska), though the total spread is no greater than in our largest Alaskan specimen. It might be expected that horn growth in the bison of the inhospitable far north would average less than in more favored species of the southwest. Six of the Alaskan maxillæ exhibit a column, or a tendency to a column, on the exterior side of the m^3 (A, Fig. 58). Columns are almost universally present on the labial side of the lower molars, the prominence of these being seemingly dependent on the state of tooth wear. Measurements of the series of Alaskan crania are given in the adjoining table.

As previously observed, *S. crassicornis* (Richardson, 1852-1854) was based on relatively small, *S. occidentalis* (Lucas, 1898) on approximately similar-sized, and *S. alaskensis* (Rhoads, 1897) on larger-sized remains.

The Alaskan crania of the Fairbanks collection may be considered according to:

- (a) when viewed dorsally, as to whether the horn-cores are:
 - directed sharply posteriorly relative to the occipital plane (A.C.-F:A.M. 30595, Fig. 57) or
 - directed more parallel to the same plane and at right angles to the skull axis (A.C.-F:A.M.30600, Fig. 57), or
- (b) when viewed posteriorly, as to whether the core bases are:
 - depressed relative to the plane of the frontals (A.C.-F:A.M.30601, Fig. 57), or
 - more continuous with that plane (A.C.-F:A.M.30523, Fig. 57).

And when the horn sheaths are retained, the specimens may be again divided:

- (c) when viewed posteriorly, as to whether the sheath tips tend:
 - to extend straight out from the skull (apparently *S. regius* type), or
 - to recurve toward one another as in Alaskan specimens (Fig. 57).

As different groupings of the several above-enumerated variations occur, each variation seems to be mutually independent. *S. occidentalis* (Lucas) apparently resembles the smaller of the Fairbanks specimens. The type of *B. antiquus* Leidy, as observed by Lucas, conforms to the

second and rarer variation under (a); *S. alaskensis* (Rhoads), somewhat suggestive of *B. latifrons*, may represent the first variation under (b). The above several horn shapes are exemplified in both large and widespread and in smaller-sized specimens. The occiput, as viewed posteriorly, may be deep or shallow. The breadth of the condyles in the largest Alaskan male is 147 mm., and in the smallest Alaskan female, 116 mm. The difference in stature, as gauged in the metacarpi, was marked, the shortest specimen measuring but 81% of the longest.

Sixteen notably smaller Alaskan crania or partial crania with very slender horns are interpreted as having belonged to cows. The rareness of the examples of the cow in this rich collection parallels the absence in the literature of reports of females from United States localities (with the exception, perhaps, of Rancho La Brea). In the younger of the Alaskan males, in which the sutures are less consolidated and the cores slenderer, the horn sheaths do not extend so far on to the skull, the core and frontal being separated by the non-sheathed core-base. In bulls in their prime, with the tips of the horn sheaths unworn, the sheaths, measured on the outer curve, may be 50% longer than the core itself.

As a preliminary to a needed reëxamination of the supporting material, in the light of the great series of remains from Alaska, the more important references to extinct American bison in the literature are grouped below according to area. As noted above, these remains have been placed under some twenty named species. The most magnificent of all is *B. regius* Hay from Kansas, in which the spread between core tips was approximately six feet. Other large forms are seen in the types of *B. chaneysi* Cook and *B. latifrons* Leidy. The smaller-horned forms include the types of *B. antiquus* Leidy, *B. taylori* Hay and Cook, *B. oliverhayi* Figgins, *B. texanus* Hay and Cook and *B. californicus* Rhoads. The Alaskan type, *B. crassicornis* Richardson, is, as noted above, of an individual of about the size of the Alaskan type, *B. occidentalis* Lucas, and of similar small size compared to the type specimen of *B. alaskensis* Rhoads. (See opposite measurement table.)

As noted on a preceding page, for the purpose of a preliminary survey, the recorded Quaternary forms are grouped in the following lists under *Bison* and *Superbison* according to area of occurrence.

TABLE XIII
MEASUREMENTS OF THE TYPE SPECIMENS OF NAMED SPECIES OF AMERICAN QUATERNARY BISON AND OF CHARACTERISTIC EXAMPLES OF THE NEW ALASKAN CRANIA

[Millimeters]

		Base of Horn-core			Length of Horn-core		Width between Tips of Horn-cores
		Vertical Diameter	Transverse Diameter	Circum- ference	Along Upper Curve	Along Lower Curve	
(1)	<i>S. latifrons</i> , Ky.....	150	175	532			
* (3)	<i>S. species</i> , Ohio.....	146	166	520		840	1775
(5)	<i>S. alleni</i> , Kans.....	115	140	415		770	
(5a)	<i>S. cramptonus</i> , Kans.....	130	150			720	
(5b)	<i>S. regius</i> , Kans.....	147	160	476		910	(1730)
(6)	<i>S. ferax</i> , Nebr.....	118	128	360		(560))	
(6a)	<i>S. angularis</i> , Nebr.....			485		778	1541
(6b)	<i>S. rotundus</i> , Nebr.....			426		(759))	((1578))
(8)	<i>S. chaneqi</i> , Tex.....	120	145	421		540	1063
(9)	<i>S. arizonica</i> , Ariz.....	140	152	442		(650))	((1500))
(11b)	<i>S. "alaskensis"</i> , Alaska..			410		497	1130
* (11)	<i>S. crassicornis</i> , ref., Alaska						
	"	115	125	390		502	1200
	"	110	118	360		450	975
	"	102	112	345		405	(1000)
	"	100	116	355		360	780
	"	112	113	360		410	(1110)
	"	95	106	325		345	830
	"	90	95	300		300	(860)
	" type.....	92	106	318			
(11a)	<i>S. "occidentalis"</i> , Alaska.	96	102	300		298	725
						((270))	
(1x)	<i>B. antiquus</i> , Ky.....	102	122	364		290	((340))
* (3x-1)	<i>B. species</i> , Ind.....	90	103			355	880
* (5x)	<i>B. species of Williston</i> mount, Kans.....	92	107	325		310	880
(5x-1)	<i>B. kansensis</i> , Kans.....	90	97	290			((840))
(7x)	<i>B. taylori</i> , N. Mex.....	102	109	328		380	
(7x-1)	<i>B. oliverhayi</i> , N. Mex.....			345		312	
(8x-1)	<i>B. figninis</i> , Tex.....	70	120	310			
(8x-2)	<i>B. texanus</i> , Tex.....	94	100				720
(10x)	<i>B. californicus</i> , Calif.....	120	125	355		385	914
(12)	<i>B. bison</i> , ref.....	88	84	280		226	615

() approximate; () estimated; *referred specimens, for comparison. Measurements by C. Bertrand Schultz.
iCol.M.1147, maximum spread of horn-cores (1170 mm.) greater than width between tips (1063 mm.).

Summary of Recorded Quaternary Species and Races¹

(A) EAST OF THE MISSISSIPPI

- (1) *Superbison latifrons* (Harlan, 1825), from Kentucky.
TYPE.—Fragment of skull with horn-cores, A.N.S.P. Coll.
- (1x) *Bison antiquus* Leidy (1852), from Kentucky.
TYPE.—Partial horn-core, A.N.S.P. Coll.
- (2a-g) *Superbison* or *Bison* species (remains fragmentary), from:
- (2a) Florida.
EXAMPLE.—Skull, N.M. Coll.
- (2b) Georgia.
EXAMPLE.—Ramal fragment, A.N.S.P. Coll.
- (2c) South Carolina.
EXAMPLE.—Teeth.
- (2d) Pennsylvania.
EXAMPLE.—Remains of three individuals.
- (2e) Massachusetts.
EXAMPLE.—Maxilla of a calf, Boston Soc. Nat. Hist. Coll.
- (2f) New York.
EXAMPLE.—Skull, Syracuse Univ. Coll.
- (2g) Mississippi.
EXAMPLE.—Teeth, A.N.S.P. Coll.
- (3) *Superbison* species, from Ohio.
EXAMPLE.—Horn-cores and part of forehead, Cincinnati Soc. Nat. Hist. Coll.
- (3x) *Bison sylvestris* Hay (1915), from Ohio.
TYPE.—Portions of skull and right ramus, Norwalk (Ohio) Mus. Coll.
- (3x⁻¹) *Bison* species, from Indiana.
EXAMPLE.—Skull, Earlham College Coll., Richmond, Indiana.

(B) WEST OF THE MISSISSIPPI

- (4) *Superbison* species, from Snake River, Idaho.
EXAMPLE.—Skull, C. W. Greene Coll. in Stanford Univ
- (4x) *Bison* species, from Iowa.
EXAMPLE.—Fragment with single horn-core, N.M.2349.
- (5) *Superbison alleni* (Marsh, 1877), from Kansas.
TYPE.—Left horn-core, Y.P.M.911.
- (5a) *Superbison crampianus* (Cope, 1894), from Kansas.
TYPE.—Portions of skull and horn-cores, A.N.S.P.3.

¹ According to Lucas (1899, p. 756) *Bos scaphoceras* Cope, type from Nicaragua, equals *Ovis*; *Bison alicornis* Marsh equals *Triceratops*; and *Bison appalachicolus* Rhoads equals *Ovibos*.

- (5b) *Superbison regius* (Hay, 1914), from Kansas.
TYPE.—Skull, A.M.14346.
- (5x) *Bison* species of Williston's mount, from Kansas.
EXAMPLE.—Mounted skeleton, Kansas Univ. Mus. Coll.
- (5x⁻¹) *Bison kansensis* McClung (1905), from Kansas.
TYPE.—Horn-core and partial cranium, Kansas Univ. Coll.
- (6) *Superbison ferox* (Marsh, 1877), from Nebraska.
TYPE.—Broken horn-core, Y.P.M.910.
- (6a) *Superbison angularis* (Figgins, 1933), from Nebraska.
TYPE.—Portion of skull with horn-cores, Hastings Mus. 4710 [Col.M.1164].
- (6b) *Superbison rotundus* (Figgins, 1933), from Nebraska.
TYPE.—Portion of skull with horn-cores, Col.M.1187.
- (6x) *Bison* species, from Nebraska.
EXAMPLE.—Assembled skeleton, N.S.M.1-31-11-31.
- (7x) *Bison taylora* Hay and Cook (1928), from New Mexico.
TYPE.—Skeleton, Col.M.1236.
- (7x⁻¹) *Bison oliverhayi* Figgins (1933), from New Mexico.
TYPE.—Crushed skull, Col.M.1240.
- (8) *Superbison chaneyi* (Cook, 1928), from Texas.
TYPE.—Partial skull with horn-cores, Col.M.1147.
- (8x) *B. (Stelabison) francisi* Figgins (1933), from Texas.
TYPE.—m², Col.M.1363.
- (8x⁻¹) *B. (Simobison) figginsi* Hay and Cook (1930), from Texas.
TYPE.—Mount, Col.M.574.
- (8x⁻²) *Bison texanus* Hay and Cook (1928), from Texas.
TYPE.—Skull and partial skeleton, Col.M.629.
- (9) *Superbison arizonica* (Blake, 1898), from Arizona.
TYPE.—Horn-cores, Univ. Ariz. Mus. Coll.
- (10x) *Bison californicus* Rhoads (1897), from California.
TYPE.—Posterior cranium with both horn-cores, A.N.S.P.297.
- (10x⁻¹) *Bison* species (Condon, 1902), from Oregon.
EXAMPLE.—Skull, (?)Univ. Oreg. Coll.
- (10x⁻²) *Bison* species, from Valley of Mexico.
EXAMPLE.—Detached m₁, F:A.M.23346.

(c) ALASKA

- (11) *Superbison crassicornis* (Richardson, 1854), from Alaska.
TYPE.—Portion of skull with broken horn-cores, Brit. Mus. 1A.

- (11a) *Superbison occidentalis* (Lucas, 1898), from Alaska.

TYPE.—Partial skull with horn-cores, N.M.4157.

- (11b) *Superbison alaskensis* (Rhoads, 1897), from Alaska.

TYPE.—Skull and horn-cores, Univ. Penna. 13754.

RECENT SPECIES AND SUBSPECIES

- (12) *Bison bison* (Linnaeus), genotypic species, Recent.
 (12x⁻¹) *Bison bison bison* Figgins (1933) (Southern form), from Texas.
 EXAMPLE.—Skull and teeth, Col.M.628.
 (12x⁻²) *Bison bison septentrionalis* Figgins (1933) (Northern form), from Nebraska.
 TYPE.—Skull, Col.M.1362.
 (12x⁻³) *Bison bison haningtoni* Figgins (1933) (Highland form), from Colorado.
 TYPE.—Mount, Col.M.2.
 (12x⁻⁴) *Bison bison oregonus* Bailey (1932), from Oregon.
 TYPE.—Skull and skeleton, N. M. Biol. Surv. Coll. 250145.
 (13) *Bison bison athabascæ* Rhoads (1897) (Woodland form), from Canada.
 TYPE.—Adult male, Geol. Mus., Ottawa, Canada.
 (14) *Bison bison pennsylvanicus* Shoemaker (1915), from Pennsylvania.

Detailed Lists of Types, Referred Specimens, and Synonymy

(A) EAST OF THE MISSISSIPPI

(1) *Superbison latifrons* (Harlan)

From Kentucky

Bos latifrons HARLAN, 1825, Fauna Americana, p. 273.

Bison latifrons (HARLAN), LEIDY, 1852, Proc. Acad. Nat. Sci. Phila., VI, p. 117; 1852, Smithson. Contrib. Knowl., V, Art. 3, p. 8, Pl. I. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 767. COOK, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 3, pp. 35, 36.

TYPE.—Fragment of skull with horn-cores. A.N.S.P. Coll. From Big Bone Lick, Kentucky.
 (Spread = 6 feet from tip to tip.) Figured by Leidy, 1852, Pl. I.

(1x) *Bison antiquus* Leidy

From Kentucky

Bison antiquus LEIDY, 1852, Proc. Acad. Nat. Sci. Phila., VI, p. 117; Smithson. Contrib. Knowl., V, Art. 3, p. 11, Pl. II, Fig. 1. ALLEN, 1876, American Bisons, Living and Extinct, p. 21 (in part). LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 759, Pls. LXVII, LXVIII. HAY, 1913, Proc. U. S. Nat. Mus., XLVI, p. 164, Text-Fig. 1.

Bison latifrons (HARLAN), LEIDY, 1869, Journ. Acad. Nat. Sci. Phila., VII, p. 371 (in part).

Bos priscus LYDEKKER, 1898, Wild Oxen, Sheep and Goats of All Lands, p. 61.

TYPE.—Partial horn-core on A.N.S.P. Coll. From Big Bone Lick, Kentucky.
 fragment. Figured by Leidy, 1852, Pl. II, Fig. 1; by Lucas, 1899, Pls. LXVII and LXVIII; by Hay, 1913, Text-Fig. 1.

(2a) (?) **Superbison** or **Bison** species

From Florida

Bison latifrons (HARLAN), LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, pp. 756, 767, Pl. LXXXIII. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 327.

Bison sp. indet. HAY, 1923, Carn. Inst. Wash. Pub. 322, pp. 263, 376.

EXAMPLE.—Imperfect skull. N.M. Coll. From Withlacoochee River, Florida.
 Metacarpal. N.M. 1989 From Peace Creek, Florida.
 Figured by Lucas, 1899, Pl. LXXXIII.
 Detached teeth. From Peace Creek, Florida.

(2b) (?) **Superbison** or **Bison** species

From Darien, Georgia

Bos LINNÆUS, COUPER, 1842, Proc. Acad. Nat. Sci. Phila., I, p. 216.

"Pachyderm" OWEN, 1847, Journ. Acad. Nat. Sci. Phila. (2), I, p. 18, Pl. vi.

Bison latifrons (HARLAN), LEIDY, 1854, Proc. Acad. Nat. Sci. Phila., VII, p. 89. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 769. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 327; 1923, Carn. Inst. Wash. Pub. 322, p. 261.

Bison antiquus LEIDY, LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 760.

EXAMPLE.—Fragment of ramus with teeth. A.N.S.P. Coll. From Darien, Brunswick, Georgia.
 Figured by Owen, 1847, Pl. vi.

(2c) (?) **Superbison** or **Bison** species

From South Carolina

Bison latifrons (HARLAN), LEIDY, 1860 (HOLMES' Post-Pliocene Fossils of South Carolina, p. 110, Pl. xvii, Figs. 15, 16). ALLEN, 1876, American Bisons, Living and Extinct, pp. 6, 13. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 769. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 327; 1923, Carn. Inst. Wash. Pub. 322, p. 260.

EXAMPLE.—Teeth. From Ashley River, South Carolina.

(2d) (?) **Superbison** or **Bison** species

From Pennsylvania

Bos LINNÆUS, WHEATLEY, 1871, Amer. Journ. Sci. (3), I, p. 384. COPE, 1871, Proc. Amer. Phil. Soc., XII, p. 96. MERCER, 1899, Journ. Acad. Nat. Sci. Phila., XI, p. 280.

Bison sp. indet. (*Bos*) HAY, 1923, Carn. Inst. Wash. Pub. 322, pp. 256, 312.

EXAMPLE.—Remains of three individuals of *Bos*.

From Port Kennedy Cave,
Pennsylvania.

(2e) (?) **Superbison** or **Bison** species

From Massachusetts

Bison bison (LINNÆUS), ALLEN (G.M.), 1920, Journ. Mamm., I, p. 161, Fig. 2. HAY, 1923, Carn. Inst. Wash. Pub. 322, p. 266.

EXAMPLE.—Maxilla of a calf.

Boston Soc.
Nat. Hist. Coll.

From Orleans, Cape Cod.
Collected by Dr. A. W. Gra-
bau.
Figured by Allen, 1920, Fig. 2.

(2f) (?) **Superbison** or **Bison** species

From New York

Bison bison (LINNÆUS), UNDERWOOD, 1890, Amer. Nat., XXIV, p. 953. HAY, 1923, Carn. Inst. Wash. Pub. 322, p. 266.

EXAMPLE.—Skull of bison.

Syracuse
Univ. Coll.

From Syracuse, Onondaga
County, New York.

(2g) (?) **Superbison** or **Bison** species

From Mississippi

Bos LINNÆUS, DICKESON, 1846, Proc. Acad. Nat. Sci. Phila., III, No. 5, pp. 106, 107. *Bison latifrons* (HARLAN), referred LEIDY, 1852, Smithson. Contrib. Knowl., V, Art. 3, p. 9, Pl. II, Figs. 2-7. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 769. HAY, 1923, Carn. Inst. Wash. Pub. 322, p. 265.

EXAMPLE.—Teeth.

A.N.S.P. Coll.

From Natchez, Mississippi.
Figured by Leidy, 1852, Pl. II,
Figs. 2-7.

(3) **Superbison** species

From Ohio

Bison latifrons (HARLAN), LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 769, Pl. LXXXII. HAY, 1913, *ibid.*, XLVI, p. 193, Pl. XIX, Fig. 1; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 327, Pl. XLII, Fig. 1.

- EXAMPLE.**—Horn-cores and intervening part of forehead. Cin. Soc. From Brush Creek, Adams
Nat. Hist. County, Ohio.
Coll. Figured by Lucas, 1899, Pl. LXXXII, anterior and superior views; by Hay, 1913, Pl. XIX, Fig. 1; 1914, Pl. XLII, Fig. 1 (after Allen).

(Above large-sized species probably distinct from *B. sylvestris*.)

(3x) **Bison sylvestris** Hay

From Ohio

Bison sylvestris HAY, 1915, Proc. U. S. Nat. Mus., XLVIII, p. 515, Pl. xxx, Figs. 1-4.

- TYPE.**—Portions of rear of skull and part of right ramus, with last premolar and anterior two molars. Norwalk From Huron County, Ohio.
Mus. Coll. Figured by Hay, 1915, Pl. xxx, Figs. 1-4.

(3x⁻¹) **Bison** species

From Indiana

Bison antiquus LEIDY, HAY, 1913, Proc. U. S. Nat. Mus., XLVI, p. 166, Text-Figs. 2, 3; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 317, Figs. 100, 101.

- EXAMPLE.**—Skull. Earlham College From Vincennes, Indiana.
Coll., Richmond, Figured by Hay, 1913, Text-
Indiana Figs. 2, 3; 1914, Figs. 100, 101.

(B) WEST OF THE MISSISSIPPI

(4) **Superbison** species

From Snake River, Idaho

Bison alleni MARSH, LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 766, Pls. LXXXIX, LXXX. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 326.

- EXAMPLE.**—Skull. C. W. Greene From Snake River, Idaho.
Coll. in Stanford Figured by Lucas, 1899, Pls. LXXXIX, LXXX.
Univ.

According to Hay, 1914:

Length of horn-core, upper curve = 720 mm.

Circumference at base of horn-core = 480

Two molars.

(Largest teeth in the U. S. National Museum.)

N.M. Coll.

Collected by W. H. Hackney on south bank of Snake River, 10 miles from Glenns Ferry, Idaho.

(4x) **Bison** species

From Iowa

Bison occidentalis LUCAS, HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 323, Pl. XL, Figs. 3, 4.

EXAMPLE.—Fragment with single horn-core. N.M.2349 From Hamilton County, Iowa. Figured by Hay, 1914, Pl. XL, Figs. 3, 4.

According to Hay, 1914:

Length of horn-core, upper curve = 300 mm.
 " " " " lower curve = 375

(5) **Superbison alleni** (Marsh)

From Kansas

Bison alleni MARSH, 1877, Amer. Journ. Sci. (3), XIV, p. 252. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 765, Pls. LXXVII, LXXVIII (and see footnote).

TYPE.—Left horn-core. Y.P.M.911 From Blue River, Manhattan, Kansas. Figured by Lucas, 1899, Pls. LXXVII, LXXVIII.

(5a) **Superbison crampianus** (Cope)

From Kansas

Bos crampianus COPE, 1894, Journ. Acad. Nat. Sci. Phila., IX, p. 456, Pl. XXII, Figs. 1-4.

Bison alleni MARSH, referred LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 766.

TYPE.—Portion of skull anterior to the orbits, greater part of left horn-core and smaller part of right horn-core. A.N.S.P.3 From Wellington, "near the middle of the southern part of Kansas." Figured by Cope, 1894, Pl. XXII, Figs. 1-4.

[According to Cope (1894), length of horn-core on outside curve = 720 mm.]

(5b) **Superbison regius** (Hay)

From Kansas

Bison regius HAY, 1913, Proc. U. S. Nat. Mus., XLVI, p. 192, Pl. XVIII, Figs. 1, 2; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 327, Pl. XLII, Figs. 2, 3. COOK, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 3, pp. 35, 36.

TYPE.—Skull. A.M.14346 From Hoxie, Sheridan County, Kansas. Figured by Hay, 1913, Pl. XVIII, Figs. 1, 2; 1914, Pl. XLII, Figs. 2, 3.

(5x) **Bison species**

From Kansas

Bison antiquus LEIDY, referred STEWART, 1897, Kans. Univ. Quart., VI, No. 3, p. 127, Pl. xvii, Fig. 2. LUCAS, 1899, *ibid.*, VIII, No. 1, p. 17, Pl. ix, Fig. 1.

Bison occidentalis LUCAS, 1899, *ibid.*, VIII, No. 1, p. 17, Pl. ix, Fig. 2 (side view); Proc. U. S. Nat. Mus., XXI, p. 758, Pl. lxvi (superior view). Referred McCLUNG, 1908, Kans. Univ. Sci. Bull., IV, No. 10, p. 249, Pl. xiv. Referred HAY, 1913, Proc. U. S. Nat. Mus., XLIV, No. 2021, p. 169, Text-Figs. 4, 5 and 6; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 321, Text-Fig. 102.

EXAMPLE.—Mounted skeleton.

Kans. Univ.
Mus. Coll.
[Williston mount]

From Logan (or Gove)
County, Kansas. Col-
lected and mounted by H.
T. Martin.

Figured by Stewart, 1897, Pl. xvii, Fig. 2 (side view of skull); by Lucas, 1899, Pl. ix, Fig. 1 (posterior view of skull), Fig. 2 (side view of skull and jaws); 1899, Pl. lxvi (superior view); by McClung, 1908, Pl. xiv; by Hay, 1913, Text-Figs. 4, 5 and 6; 1914, Text-Fig. 102.

(C. B. Schultz considers the specimen to resemble *B. taylori* and to come from the same general horizon.)

(Referred by Stewart, 1897, to *B. antiquus*; by Lucas, 1899, and McClung, 1908, to *B. occidentalis*.)

(5x⁻¹) **Bison kansensis McClung**

From Kansas

Bison kansensis McCLUNG, 1905, Trans. Kans. Acad. Sci., XIX, p. 157, Fig. 10. Referred HAY, 1913, Proc. U. S. Nat. Mus., XLIV, No. 1969, p. 584.

TYPE.—Horn-core and hinder
part of skull.

Kans. Univ.
Coll.

From 1½ mi. E. of North
Lawrence, Kansas. Se-
cured by C. H. Sternberg.
Figured by McClung, 1905,
Fig. 10.

(6) **Superbison ferox (Marsh)**

From the "Lower Pliocene" of Nebraska

Bison ferox MARSH, 1877, Amer. Journ. Sci. (3), XIV, p. 252. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 766, Pl. lxxxI.

TYPE.—Broken horn-core.

Y.P.M.910

Figured by Lucas, 1899, Pl.
LXXXI.

(Estimated as measuring 560+ mm. in length when complete.)

TENTATIVELY REFERRED SPECIMEN (doubtfully reported by Matthew and Cook [1909] from the Snake Creek Tertiary, representing an individual of larger size than any of the Alaskan remains).—

Right ramus with p_4 (br.)— A.M.14135 1908.
 m_3 .

$m_1-m_3 = 115$ mm., versus Recent *Bison* [A.M.(M.)3758] = 104 mm.

(6a) **Superbison angularis** (Figgins)

From Nebraska

Unnamed *Bison* species FIGGINS, 1931, Proc. Col. Mus. Nat. Hist., X, No. 3, p. 22, Pls. I, Fig. 2, No. 1; II, Fig. 3, No. 1; and III, Fig. 4, No. 1.

Bison angularis FIGGINS, 1933, *ibid.*, XII, No. 4, p. 23, Pl. IV.

TYPE.—Portion of skull with
 horn-cores.

Hastings
 Mus. 4710
 [Col.M.1164]

From Sutton, Clay County,
 Nebraska (A. M. Brook-
 ings, Director, Hastings
 Museum).

Figured by Figgins, 1931, Pls.
 I, Fig. 2, No. 1; II, Fig. 3,
 No. 1; and III, Fig. 4, No.
 1; 1933, Pl. IV.

(Measures, tip to tip, 1541 mm. and outer curve, 845 mm.)

(6b) **Superbison rotundus** (Figgins)

From Nebraska

Unnamed *Bison* species FIGGINS, 1931, Proc. Col. Mus. Nat. Hist., X, No. 3, p. 22, Pls. I, Fig. 2, No. 2; II, Fig. 3, No. 2; and III, Fig. 4, No. 2.

Bison rotundus FIGGINS, 1933, *ibid.*, XII, No. 4, p. 24, Pl. V.

TYPE.—Portion of skull with
 horn-cores.

Col.M.1187

From Dorchester, Saline
 County, Nebraska (A. M.
 Brookings, Director, Has-
 tings Museum).

Figured by Figgins, 1931,
 Pls. I, Fig. 2, No. 2; II,
 Fig. 3, No. 2; and III, Fig.
 4, No. 2; 1933, Pl. V.

(Measures, tip to tip, 1578 mm.)

(6x) **Bison** species

From Nebraska

Bison occidentalis LUCAS, BARBOUR AND SCHULTZ, 1932, Bull. Nebr. State Mus., I, No. 32, p. 263, Fig. 163.

EXAMPLE.—Assembled skele-
 ton.

N.S.M.1-31-11-31

From 8 mi. S.W. of Grand
 Island, Hall County, Ne-
 braska.

Figured by Barbour and
 Schultz, 1932, Fig. 163.

Messrs. Barbour and Schultz now consider the specimen to resemble the New Mexican *B. taylori*. (Communicated.)

(7x) **Bison taylori** Hay and Cook

From Folsom, New Mexico

Bison taylori HAY AND COOK, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 2, Pt. 1, p. 33; 1930, *ibid.*, IX, No. 2, p. 26, Pl. VIII, Figs. 1, 2; Pl. x, Figs. 2, 3.

Bison sp. *indet.* HAY AND COOK, 1930, *ibid.*, IX, No. 2, p. 30, Pl. x, Fig. 1.

Stelabison taylori (HAY AND COOK), FIGGINS, 1933, *ibid.*, XII, No. 4, p. 20, teeth figured Pl. I, Figs. 3, 4.

TYPE.—Skeleton.

Col.M.1236

From 8 mi. W. of Folsom, New Mexico.

Figured by Hay and Cook, 1930, Pl. VIII, Figs. 1, 2; Pl. x, Figs. 2, 3; by Figgins, 1933, Pl. I, Figs. 3, 4 (teeth).

[Cores of medium length and moderately curved, slighter than in *B. texanus*. Figgins (1933) figures m_3 with column, as in *B. occidentalis*, and, on character of external molar styles, transfers the species to *Stelabison*.]

TENTATIVELY REFERRED.—

Skull.

Col.M.1237

From Folsom, New Mexico. Figured by Hay and Cook, 1930, Pl. x, Fig. 1 (indeterminate).

Figgins (1933, p. 20) indicates that Cook (Hay and Cook, 1930) considers the specimen as merely the female of *B. taylori*, but that he himself considers it as of *B. occidentalis* referred.

Left partial ramus with p_3 — m_3 (br.). (w)
 $m_2 = (40)$ mm.

F:A.M.30973

From Santa Fé Pleistocene, New Mexico, 1925.

Right fragment with p_2 (br.)— m_1 . (m)

F:A.M.30974

From Santa Fé Pleistocene, New Mexico, 1925.

Left metatarsus.

F:A.M.30975

From Hot Springs, New Mexico, 1928.

(7x⁻¹) **Bison oliverhayi** Figgins

From New Mexico

Bison oliverhayi FIGGINS, 1933, Proc. Col. Mus. Nat. Hist., XII, No. 4, p. 21, Pl. II, Figs. 5, 6; Pl. III.

TYPE.—Crushed skull. (w+)

Col.M.1240

From Folsom, New Mexico. Figured by Figgins, 1933, Pl. III.

REFERRED BY FIGGINS.—

Crushed skull.

Col.M.1360

From Scotts Bluff, Nebraska. Figured by Figgins, 1933, Pl. II, Figs. 5 and 6 (dentition).

Crushed skull.

From Oklahoma.

(8) **Superbison chaneyi** (Cook)

From Vernon, Texas

Bison chaneyi COOK, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 3, p. 34, Figs. 1, 2.
 Unnamed *Bison* species, FIGGINS, 1931, *ibid.*, X, No. 3, p. 22, Pls. I, Fig. 2, No. 3;
 II, Fig. 3, No. 3; and III, Fig. 4, No. 3.

TYPE.—Partial skull with Col.M.1147 From Vernon, Texas.
 horn-cores. Figured by Cook, 1928, Figs. 1, 2; by Figgins, 1931, Pls. I, Fig. 2, No. 3; II, Fig. 3, No. 3; and III, Fig. 4, No. 3.

(Horns like "cupid bow." Size compares with largest known. Length on upper curve = 42 inches.)

TENTATIVELY REFERRED.—

Four teeth in ramal frag- From Onion Creek, Travis
 ments. County, Texas.

(Provisionally referred by Lucas [1899] to *B. latifrons*.)

Cranium. Brit. Mus. From San Felipe, on the Bra-
 Coll., London zos River, Texas.
 Figured by Carpenter, 1846,
 Figs. 1, 2; by Hay, 1913,
 Pl. XIX, Fig. 3 (after Blake).

The numerous references to this cranium in the literature are as follows:

"Extinct ox" CARPENTER, 1846, Amer. Journ. Sci. (2), I, p. 245, Figs. 1, 2.
 BLAKE, 1898, Amer. Geol., XXII, p. 69.

"Extinct bison" ALLEN, 1876, American Bisons, Living and Extinct, p. 4.

Bison latifrons (HARLAN), LEIDY, 1853, Smithsonian. Contrib. Knowl., V, Art. 3,
 p. 9. LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 769. HAY, 1913, *ibid.*,
 LXVI, p. 197, Pl. XIX, Fig. 3 (after Blake).

Bison regius HAY, referred HAY, 1924, Carn. Inst. Wash. Pub. 322a, p. 189.

(8x) **Bison (Stelabison) francisi** Figgins

From Texas

Stelabison occidentalis francisi FIGGINS, 1933, Proc. Col. Mus. Nat. Hist., XII, No. 4,
 p. 19, Pl. II, Figs. 1, 2.

TYPE.—m³. Col.M.1363 From Hearne, Robertson
 Secured by Dr. County, Texas.
 Mark Francis Figured by Figgins, 1933, Pl.
 II, Figs. 1, 2 (of m³).

REFERRED.—

Partial horn-core and Col.M.1364 From Waco, Texas.
 mandibular ramus.

Referred by J. D. Figgins, etc. fragmental specimens in the collection of the
 Agricultural and Mechanical College, College Station, Texas.

(8x⁻¹) **Bison (Simobison) figginsi** Hay and Cook

From Texas

Bison figginsi HAY AND COOK, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 2, Pt. 1, p.33. COOK, 1928, *ibid.*, VIII, No. 3, p. 35.*Simobison figginsi* HAY AND COOK, 1930, *ibid.*, IX, No. 2, p. 23, Pl. VII, Figs. 1, 2.

BARBOUR AND SCHULTZ, 1932, Bull. Nebr. State Mus., I, No. 32, p. 268.

TYPE.—Mount.

Col.M.574

From Colorado, Mitchell
County, Texas.Figured by Hay and Cook,
1930, Pl. VII, Figs. 1, 2.

QUESTIONABLY REFERRED.—

Portion of cranium with
base of right horn-core.

F:A.M.23347

From 9 mi. W. of Silverton,
Texas.(8x⁻²) **Bison texanus** Hay and Cook

From Dawson County, Texas

Bison texanus HAY AND COOK, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 2, Pt. 1, p.33; 1930, *ibid.*, IX, No. 2, p. 25, Pls. VIII, Figs. 3-5; IX, Figs. 1-3; and XI, Fig. 1.TYPE.—Skull and partial skele-
ton.

Col.M.629

From Michies, Dawson
County, Texas.Figured by Hay and Cook,
1930, Pls. VIII, Figs. 3-5;
IX, Figs. 1-3; XI, Fig. 1.

REFERRED FROM TYPE LOCALITY.—

Partial skull. (w+)

Col.M.631

(9) **Superbison arizonica** (Blake)

From the Quaternary of Arizona

Bos arizonica BLAKE, 1898, Amer. Geol., XXII, p. 65.*Bison latifrons* (HARLAN), referred LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, pp.
756, 768.

TYPE.—Horn-cores.

Univ. Ariz.
Mus. Coll.From Greaterville, in the
Pima Mountains, Arizona.[Lucas (1899, p. 756) considered *Bos arizonica* Blake as a synonym of *B.*
latifrons.]

(10x) *Bison californicus* Rhoads

From California

Bison latifrons (HARLAN), referred LEIDY, 1873, Rept. U. S. Geol. Surv. Terrs. (Hayden), I, p. 253, Pl. xxviii, Figs. 4, 5.

Bison californicus RHOADS, 1897, Proc. Acad. Nat. Sci. Phila., XLIX, p. 501, Pl. xii, Fig. 2.

Bison antiquus LEIDY, referred LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, pp. 756, 759, Pl. LXIX. HAY, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 317 (mentions as occurring in California). CHANDLER, 1916, Univ. Cal. Pub. Bull. Dept. Geol., IX, p. 124, Text-Figs. 1-12; 1916, Bull. Geol. Soc. Amer., XXVII, No. 1, p. 170. HAY, 1927, Carn. Inst. Wash. Pub. 322, pp. 121, 122 (Leidy specimen).

TYPE.—Posterior cranium with both horn-cores.

A.N.S.P.297

From Pilarcitos Valley, near San Francisco, California. Figured by Leidy, 1873, Pl. xxviii, Figs. 4, 5; by Rhoads, 1897, Pl. xii, Fig. 2; by Lucas, 1899, Pl. LXIX.

QUESTIONABLY REFERRED (approximating *Superbison* in size).—

Left crushed ramus with p_3 - m_3 , detached /I, and partial right maxilla with p^4 - m^4 . (Probably associated.) (w)
 m_3 = 52 mm.

F:A.M.31070,
B and A

From White Water Canyon, Beaumont, California.

REFERRED FROM RANCHO LA BREA (listed by Asa C. Chandler under *B. antiquus*).—

Thirteen more or less complete crania of various ages (four with horn-cores practically perfect, four entire with skull perfect or almost so, and five with dentition almost complete) and a large series of rami; in fact, parts of sixteen different animals.

U. C. Coll.

Figured by Chandler, 1916, Text-Figs. 1-12.

Chandler observed an individual variation in the Rancho La Brea skull to the extent of about 20%.

(10x⁻¹) *Bison* species (Condon)

From Oregon

Bos latifrons HARLAN, CONDON, 1902, The Two Islands and What Became of Them (not seen); 1910, A Revision of "The Two Islands," pp. 129, 130, 140, Pl. xxix.

Bison antiquus LEIDY, referred HAY, 1927, Carn. Inst. Wash. Pub. 322b, p. 124.

EXAMPLE.—Skull.

(?) Univ. Oreg.
Coll.

From 5 or 6 mi. E. of the Dalles, Oregon.
Figured by Condon, 1910, Pl. xxix.

(10x-²) **Bison** species

From Valley of Mexico

EXAMPLE.—Detached m₂.

F:A.M.23346

From vicinity of Tesopaco,
Mexico.Collected by Howard Scott
Gentry and John Hilton,
1936.

TENTATIVELY REFERRED FROM SAME LOCALITY.—

Etc. tooth fragments, F:A.M. Coll.

Left metacarpus and metatarsus, F:A.M. Coll.

Miscellaneous foot bone fragments, vertebrae and rib fragments, F:A.M. Coll.

(c) ALASKA

(11) **Superbison crassicornis** (Richardson)

From Alaska

Bos urus BUCKLAND, 1831, Appendix to Captain Beechey's Narrative, Voyage to the Pacific, II, p. 539, Pl. III, Figs. 1-7.*Bison priscus* MEYER ?, RICHARDSON, 1852-1854, Zoology of the Voyage of H.M.S. Herald, pp. 33, 139, Pls. VI, Figs. 5, 6; VII; X, Figs. 1-6; XIII, Fig. 3. Referred GILMORE, 1908, Smithsonian Misc. Coll., LI, p. 34.*Bison crassicornis* RICHARDSON, 1852-1854, *ibid.*, pp. 40, 139, Pls. IX; XI, Fig. 6; XII, Figs. 1-4; XIII, Figs. 1, 2; XV, Figs. 1-4. LEIDY, 1854, Proc. Acad. Nat. Sci. Phila., VII, p. 210. ALLEN, 1876, American Bisons, Living and Extinct, pp. 14, 15, 21, ?Pl. VIII, Fig. 12 (syn. of *B. antiquus*). LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 760, Pls. LXXIII-LXXVI. Referred GILMORE, 1908, Smithsonian Misc. Coll., LI, p. 31, Pl. X. HAY, 1913, Proc. U. S. Nat. Mus., XLVI, p. 179, Pl. XIV, Figs. 1, 2. Referred HOLLAND, 1915, Ann. Carn. Mus., IX, p. 225, Pl. XLIII.*Superbison crassicornis* (RICHARDSON), NOBIS, 1930, Nat. Hist., XXX, No. 1, p. 71.TYPE.—Portion of skull with
broken horn-cores.Brit. Mus. 1A
[Beechey Coll.]From Eschscholtz Bay,
Alaska.Figured by Buckland, 1831,
Pl. III, Fig. 1; by Richardson,
1852-1854, Pl. IX.Circumference of more perfect horn-core at base (according to Richardson,
12.6 inches) = 320 mm.

COTYPE.—Large horn-core.

Brit. Mus. 91

Figured by Richardson, 1852-
1854, Pl. XIII, Figs. 1, 2.Circumference at widest point near base (according to Richardson, 15.2
inches) = 386 mm.Richardson (1852-1854, p. 43): "... it has therefore been considered a horn-core of an older and probably a male individual of the race that produced the skull marked No. 1A, and to which, from the thickness of its horns, I have given the distinctive epithet of *crassicornis*..."

Allen (1876, p. 24) states: "...The differences existing between the remains referred by Richardson to '*B. priscus*'? and '*B. crassicornis*' are not greater than those that obtain between the two sexes of *Bison americanus*; hence it seems possible that all of the bison remains described from Eschscholtz Bay may belong to one and the same species, the larger representing the male and the smaller the female, of the form Richardson named *Bison crassicornis*, which is very probably the same as the *B. antiquus* of Leidy..."

Lucas (1899, p. 761) states: "...The validity of Richardson's *Bison crassicornis* hinges on the question of the identity of his type I, A, with Leidy's *B. antiquus*..."

REFERRED BY VARIOUS AUTHORS TO *B. crassicornis*—TYPE-SIZED SPECIMENS.—

(a) By Lucas:

Horn-core with partial cranium.	N.M.1584	From Alaska. Figured by Lucas, 1899, Pls. LXXIII and LXXIV.
(See discussion by Lucas.)		
Partial skull with broken horn-cores.	Univ.Pa.13753	From Point Barrow, Alaska. Figured by Lucas, 1899, Pl. LXXV.

(b) By Gilmore and Hay:

Cranium.	N.M.5726	From Little Minook Creek, near Rampart, Alaska. Figured by Gilmore, 1908, Pl. x; by Hay, 1913, Pl. xiv, Figs. 1, 2.
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(c) By Holland:

Skull. (Distance between horn tips = 1155 mm.)	C.M.3247	From the Yukon, Alaska. Figured by Holland, 1915, Pl. XLIII.
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REFERRED BY GILMORE AND HAY TO *B. alleni*—LARGER THAN TYPE-SIZED [see *S. alaskensis* (Rhoads)].—

Skull with both horn- cores.	N.M.2383	From near Rampart, Alaska. Presented to the U. S. Na- tional Museum by Messrs. McLain and Ballou, through the efforts of Gen. Wilcox, U.S.A. Figured by Gilmore, 1908, Pl. xi; by Hay, 1914, Pl. xli.
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PREVIOUSLY REFERRED TO *B. priscus*—SMALLER THAN TYPE-SIZED.—

(a) By Richardson:

Partial cranium with horn- cores.	Brit. Mus. 24589	From Eschscholtz Bay, Alaska.
(Probably represents an unusually small bull or a large cow.)		

(b) By Gilmore:

Horn-cores.		From the "Palisades" on the Yukon River.
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[Appear to resemble the Richardson figure (see Pl. XIII, Fig. 3).]

REFERRED TO *S. crassicornis*, SPECIMENS SECURED BY THE JOINT ALASKA COLLEGE-AMERICAN MUSEUM EXPEDITION.—

While these specimens are placed under the Richardson species, which here is

tentatively considered to include the two Alaskan species of Rhoads and Lucas, the Fairbanks series might be conveniently subdivided, the larger remains being held under *S. crassicornis alaskensis* (Rhoads) and the smaller specimens under *S. crassicornis* proper. As observed above, *S. crassicornis occidentalis* (Lucas) represents an individual differing but slightly from the *S. crassicornis* type specimen, as judged by figures and measurements. The Fairbanks series includes some one hundred and fifty crania and partial crania, nearly two hundred mandibular rami and partial rami, and skeletal remains. (Six crania are nearly complete and three of these retain the dentitions.) See measurement table, page 575, and Figs. 57, 58, for outstanding specimens.

(11a) **Superbison occidentalis** (Lucas)

From Alaska

Bison antiquus LEIDY, referred ALLEN, 1876, American Bisons, Living and Extinct, p. 21, Pl. IV.

Bison occidentalis LUCAS, 1898, Science (2), VIII, p. 678; 1899, Kans. Univ. Quart., VIII, p. 17 (mentions only); Proc. U. S. Nat. Mus., XXI, p. 758, Pl. LXV. GILMORE, 1908, Smithsonian Misc. Coll., LI, p. 34, Pl. XII. HAY, 1913, Proc. U. S. Nat. Mus., XLVI, p. 169, Pl. IX, Figs. 3, 4; Pl. X, Figs. 1, 2, 3, a; and Pl. XI, Figs. 3, 4; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 319, Pl. XXXIX, Figs. 2, 3; Pl. XL, Figs. 1, 2.

Stelabison occidentalis francisi FIGGINS, 1933, Proc. Col. Mus. Nat. Hist., XII, No. 4, Pl. I, Figs. 1, 2.

TYPE.—Partial skull with horn-cores.	N.M.4157 (Richardson, collector)	From Fort Yukon, Alaska. Figured by Lucas, 1899, Pl. LXV; by Hay, 1913, Pl. IX, Figs. 3, 4; 1914, Pl. XXXIX, Figs. 2, 3.
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[Figgins (1933, p. 18): "... As the type of *Bison occidentalis* consists of only the horncores, frontals and occipital, a question must attach to the characters of the dentition..."]

REFERRED BY LUCAS.—

Specimens from St. Michael, Fort Yukon, figured by Allen, 1876, Pl. IV, *B. antiquus*.

REFERRED BY GILMORE.—

Rear of skull bearing complete horn-cores.	N.M.2643	From Old Crow River, Canada. Figured by Gilmore, 1908, Pl. XII; by Hay, 1913, Pl. XI, Figs. 3, 4.
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REFERRED BY HAY.—

Skull.	A.M.13721	From Dawson, Yukon Territory. Figured by Hay, 1913, Pl. X, Figs. 1-3; 1914, Pl. XL, Figs. 1, 2.
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Figgins (1933) cites as standing for type of *Stelabison occidentalis*, and figures m^s with pillar, Pl. I, Figs. 1, 2.

(11b) *Superbison alaskensis* (Rhoads)

From the Pleistocene of Northern Alaska

Bison alaskensis RHOADS, 1897, Proc. Acad. Nat. Sci. Phila., XLIX, p. 490, Pl. XII, Figs. 3, 6.*Bison crassicornis* RICHARDSON, LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 756.

TYPE.—Skull and horn-cores. Univ. Pa. 13754 From near Point Barrow
Alaska.
Figured by Rhoads, 1897, Pl.
XII, Figs. 3, 6.

The type specimen (Univ. Pa. 13754), as shown in the measurement table (page 575), exceeds in dimensions the largest of the Fairbanks crania. Were it desired to divide the Alaska remains according to size, the smaller specimens would be referred to *S. crassicornis* proper, which *S. crassicornis occidentalis* (Lucas) approximates, and the larger to *S. crassicornis alaskensis* (Rhoads).

RECENT SPECIES AND SUBSPECIES

XI. BISON H. SMITH

Genotypic species, *Bison bison* (Linnæus)

The Recent remnants of the genus in North America have been placed in a species and five subspecies.

(12x⁻¹) *Bison bison bison* Figgins

Southern Form

Bison bison (LINNÆUS), HAY AND COOK, 1930, Proc. Col. Mus. Nat. Hist., IX, No. 2, p. 30, Pl. XI, Figs. 2, 3.*Bison bison bison* FIGGINS, 1933, *ibid.*, XII, No. 4, p. 27, Pl. VI.

TYPICAL OF SOUTHERN FORM.—

Skull and teeth.

Col. M. 628 From Michies, Dawson County, Texas,
Figured by Hay and Cook, 1930, Pl. XI,
Figs. 2, 3; by Figgins, 1933, Pl. VI.

(12x⁻²) *Bison bison septentrionalis* Figgins

Northern Form

Bison bison septentrionalis FIGGINS, 1933, Proc. Col. Mus. Nat. Hist., XII, No. 4, p. 28, Pl. VII.

TYPE.—Skull.

Col. M. 1362 From 6 mi. N.E. of Palmer, Nebraska,
Figured by Figgins, 1933, Pl. VII, and
also tooth series.

(12x⁻³) *Bison bison haningtoni* Figgins

Highland Form

Bison bison haningtoni FIGGINS, 1933, Proc. Col. Mus. Nat. Hist., XII, No. 4, p. 30, Pls. VIII, IX.

TYPE.—Mount.

Col. M. 2 From Rock Creek, Park County, Colo-
rado.
Figured by Figgins, 1933, Pls. VIII, IX.

COTYPE.—Adult male skull.

Col.M.1369

From Alma, Park County, Colorado.
Figured by Figgins, 1933, Pl. VIII.

(12x-4) *Bison bison oregonus* Bailey

From the Westernmost Point Reached by Buffalo,
the Blue Mountains of Oregon, Malheur Cave

Bison bison oregonus BAILEY, 1932, Proc. Biol. Soc. Wash., XLV, p. 48. Referred Figgins, 1933,
Proc. Col. Mus. Nat. Hist., XII, No. 4, p. 32.

TYPE.—Skull and skeleton.
(Adult male.)

N.M.Biol.
Surv.Coll.
250145

From the dry bed of Malheur Lake,
Oregon.
Collected, 1931, by George M. Ben-
son, Keeper of Malheur Wild Life
Refuge.

(Similar in general characters to *Bison bison bison* of southwestern Texas, but slightly larger.
With *Bison bison athabascæ* there are greater differences. With *Bison occidentalis*, its nearest
fossil relative, there is no close connection.)

(13) *Bison bison athabascæ* Rhoads

Woodland Form
From Canada

Bos or *Bison americanus* (= *Bison bison*).

"*Bison americanus*, var.?" SETON [THOMPSON], 1886, Proc. Canad. Inst., III, p. 114.

Bison bison athabascæ RHOADS, 1897, Proc. Acad. Nat. Sci. Phila., XLIX, p. 493.

TYPE.—Adult male.

Geol.Mus.,
Ottawa,
Canada

Secured presumably in March, 1892,
by Indians within 50 mi. S.W. of
Fort Resolution, Great Slave Lake.

(Specimen consists of well-mounted skin, with accompanying skull and horn-cores separate.)

(14) *Bison bison pennsylvanicus* Shoemaker

From Pennsylvania

Bison americanus pennsylvanicus SHOEMAKER, 1915, A Pennsylvania Bison Hunt, p. 9.

Shoemaker (1911, pp. 16, 17) states "... In color the Pennsylvania bison was very dark, many
of the old bulls being coal black, with grizzly white hairs around the nose and eyes. The hair
was very short, with a tendency to crispness or curliness, especially at the joints. The hump, so
conspicuous on the western bison was notable by its absence... The legs were long, and fore and
back legs evenly placed, the heavy front and meagre hind-quarters of the western bison were not
present, in other words the Pennsylvania bison was a beautifully proportioned beast... Appar-
ently the horns were much like those of *Bison bonasus* of Lithuania and the Caucasus..."

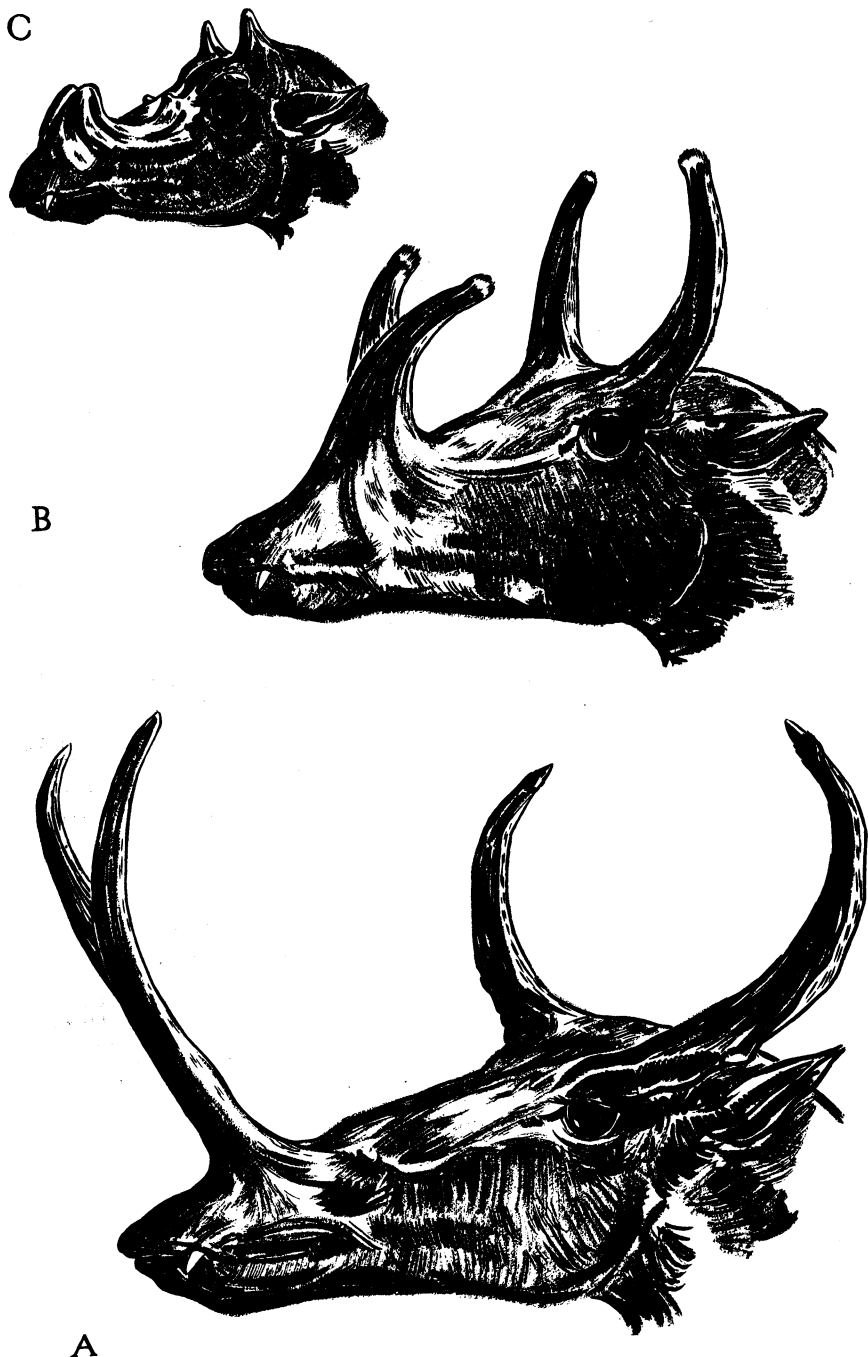


FIG. 59. Protoceratids of the American Tertiary.
Reconstructions $\times$ approximately $\frac{1}{2}$.

- (c) *Protoceras* Marsh, of the Oligocene (p. 609)
- (B) *Syndyoceras* Barbour, of the Lower Miocene (p. 607)
- (A) *Prosynthetoceras*, n.subg., of the Late Tertiary (p. 602)

FAMILY IV.—PROTOCERATIDÆ

(Marsh, 1891)

DIVISION.—PROTOCERATINI

Subfamily 1.—Synthetoceratinæ

I. SYNTHETOCERAS STIRTON

II. PROSYNTHETOCERAS, N. SUBG.

Subfamily 2.—Syndyoceratinæ

III. SYNDYOCERAS BARBOUR

Subfamily 3.—Protoceratinæ

IV. PARATOCERAS, NEW GENUS

**V. PROTOCERAS MARSH (AND
CALOPS MARSH)**

VI. PSEUDOPROTOCERAS COOK

Figures 2C, 59-63 and (in part) 2, 2A, 23, 65, 66

The Protoceratidæ of Marsh embraces the peculiar rostral-horned forms of the American Tertiary exemplified in *Protoceras* of the early Middle Tertiary and the new *Paratoceras* of the Late Tertiary; *Syndyoceras* of the Middle Tertiary; and *Synthetoceras* and the new *Prosynthetoceras* of the Late Tertiary. The rostrocranial armament and enlarged saber-form upper canines of the males, the small uninflated tympanic and the short detached metacarpals are outstanding characters. It is unexpected to discover in the Late Tertiary large and spectacular representatives of a family believed to have been extinct since the Middle Tertiary. Perhaps the survival of these strange creatures, with primitive auditory bullæ and limbs, actually may have been due in considerable measure to their unique defensive armament.

The cranial processes of the Protoceratidæ, ostensibly a different adaptation from the horn-pedicles of the Cervidæ and the horn-cores of the Antilocapridæ, recall in some degree the horn processes of certain of the Giraffidæ. There is evident need for further comparative study of

the cranial armament of all five Artiodactyl families. The present family at once differs from the Cervidæ, Antilocapridæ and Bovidæ in the remarkable development of the muzzle with its unique rostral horn or horns, and in the form of the auditory area, dentition and feet. The specialization of the muzzle is greater than in the case of the Bovid *Saiga* or Oreodont *Cyclopidius*. The four-toed manus parallels the similar primitive condition in the Hypertragulidæ. It is largely on the foot characters that *Protoceras* has from time to time been placed in the latter family.

Since this chapter was originally sent to press, our party, under John Lynch, operating at the MacAdams Ranch, Clarendon, Texas, type locality, has obtained four¹ skulls with orbital and forked rostral horns, a palate with unworn dentition and seven partial mandibles of *Synthetoceras*. The crania and mandibles exhibit the loss of p_2^2 and reduction of p_3^3 . A fifth cranium of a more primitive form has been discovered in southeastern Texas, the same differing from the above specimens in its considerably smaller size, retained p_2^2 s and notably smaller, shorter-crowned molars. This specimen has been available for study through the helpful coöperation of Dr. Mark Francis of the Agricultural and Mechanical College of Texas. It is made the type of *Prosynthetoceras francisi*, named in honor of Dr. Francis. *Paratoceras* is based on a mandibular ramus from the MacAdams Ranch quarry. It is of smaller size than the above specimens and differs markedly from *Synthetoceras* in the large and nonreduced premolars and low-crowned molars, in these characters more resembling *Protoceras* of the White River. (Certain relatively diminutive and more *Leptomeryx*-sized remains of heretofore unobserved form from the Late Tertiary of Nebraska and New Mexico are referred to a new genus, *Pseudoceras*, and briefly discussed in the Appendix. When better known, these remains possibly may prove to be allied more nearly to the Protoceratidæ than to the Camelidæ.)

While it might be preferable to refer the three genera, *Synthetoceras*, *Syndyoceras* and *Protoceras*, to distinct divisions, the same are here considered as of one Protoceratini division of three subfamilies:

- 1.—SYNTHETOCERATINÆ. Late Tertiary.
- 2.—SYNDYOCERATINÆ. Middle Tertiary.
- 3.—PROTOCERATINÆ. Middle and Late Tertiary.

(Description continued p. 602)

¹A fifth and well-preserved skull (F:A.M.33413), distal end of rostral horn missing, has been secured. Distance from vertex to anterior face of rostral horn, 390 mm.

TABLE XIV

PROTOCERATID GENERA, SUBGENERA AND SPECIES OF THE AMERICAN MIDDLE AND LATE TERTIARY—OCCURRENCE AND TOTALS OF AVAILABLE SPECIMENS

[Roman and arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in () from type area for the particular species.
(See Introduction, page 7.)]

	Genus Number	LATE TERTIARY				Genus Number	MIDDLE TERTIARY		
		Clarendon (& *S.E. Section), Tex.	Sioux (& *Dawes) Co., Nebr.	Specimen Count			Harrison, Nebr.	<i>Protoceras</i> (& *Chadron, Nebr.) Beds, White River, S. Dak.	Specimen Count
PROTOCERATINI									
<i>Synthetoceras</i> Stirton	I	(1) *(1a)		20					
<i>Prosynthetoceras</i> , n. subg.	II	*(2)	(3) *(3a)	3	<i>Syndyoceras</i> Barbour	III	(1)		2
<i>Paratoceras</i> , n.g.	IV	(1)		2	<i>Protoceras</i> Marsh	V		(1) (2) (3) (4) (5)	26
					<i>Pseudoprotoceras</i> Cook	VI		*(6)	1
Total				25	Total				29
					Grand Total				54

SUMMARY OF PROTOCERATINI SPECIMENS

Genus No.		Crania	Horns	Maxillæ	Mandibles	Limbs	Total Elements	Assoc. Elements	Total Specimens
I	<i>Synthetoceras</i> Stirton.....	5	[5]	7 [5]	8	5	30	10	20
II	<i>Prosynthetoceras</i> , n.subg.....	1	2 [1]	[1]	1		5	2	2
III	<i>Syndyoceras</i> Barbour.....	1	[1]	[1]	[1]	2 [1]	6	4	2
IV	<i>Paratoceras</i> , n.g.....				2		2		2
V	<i>Protoceras</i> (and <i>Calops</i>) Marsh....	19	[6]	16 [14]	8 [5]	6 [4]	55	29	26
VI	<i>Pseudoprotoceras</i> Cook.....	1		[1]		[1]	3	2	1
		27	14	26	20	14	101	47	54

[] associated.
* refers to locality as shown in column heading.
Alignment of Late and Middle Tertiary forms is not intended to indicate actual ancestry.

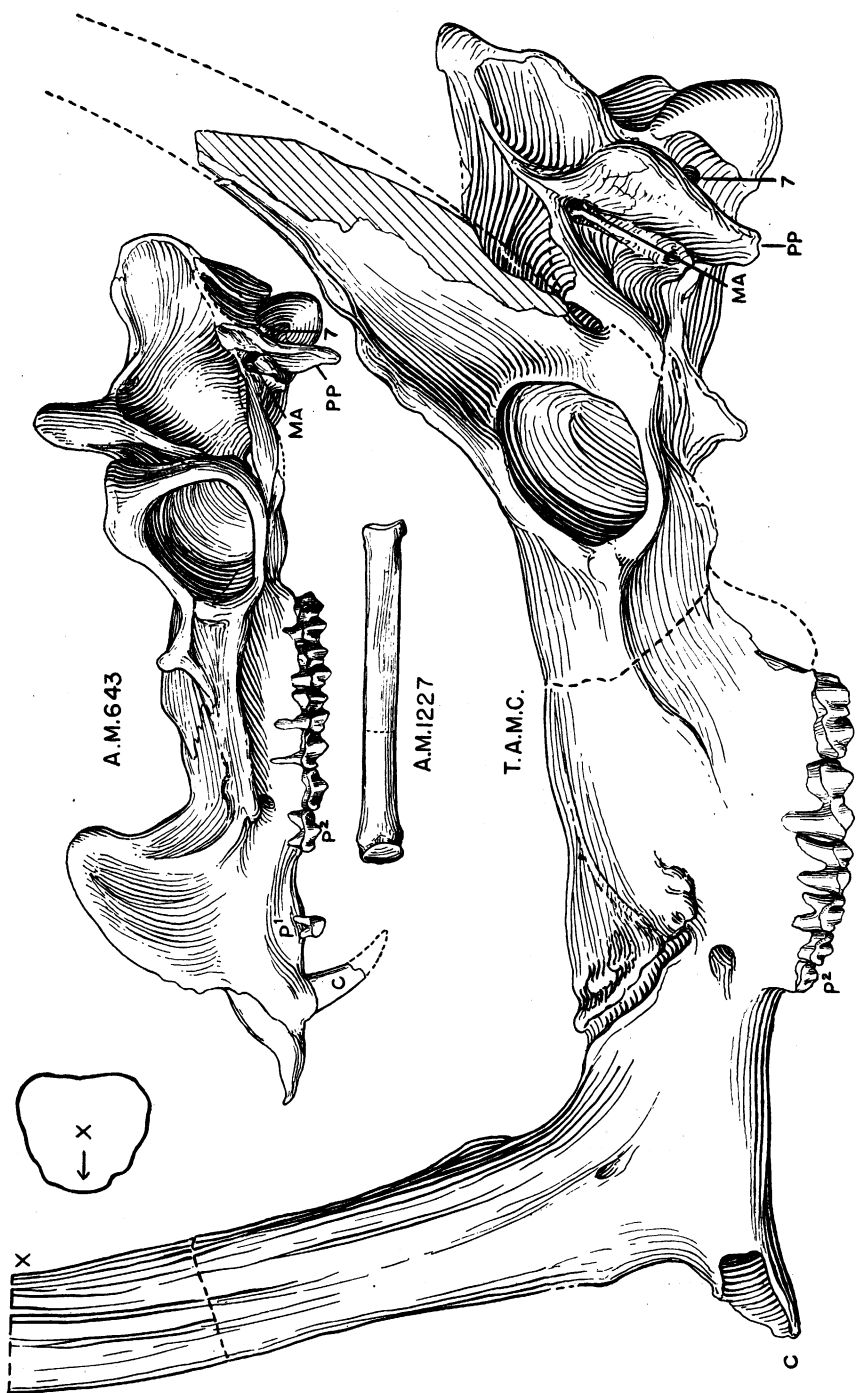


FIG. 60. A.M.643 and 1227 (3d metacarpal), *Protoceras celer* Marsh, ref., from South Dakota. T.A.M.C., *Prosyntheloceras francisci*, subgenotype, from San Jacinto County, Texas.

Lateral views $\times \frac{1}{2}$. MA, auditory meatus; PP, paracarpal process; X, cross section of horn (and see Fig. 61); 7, condylar foramen. (See also Figs. 62, 63 [A.M.643]; 2, 2A, 61-63 [T.A.M.C.]; and pages 612, 606.)

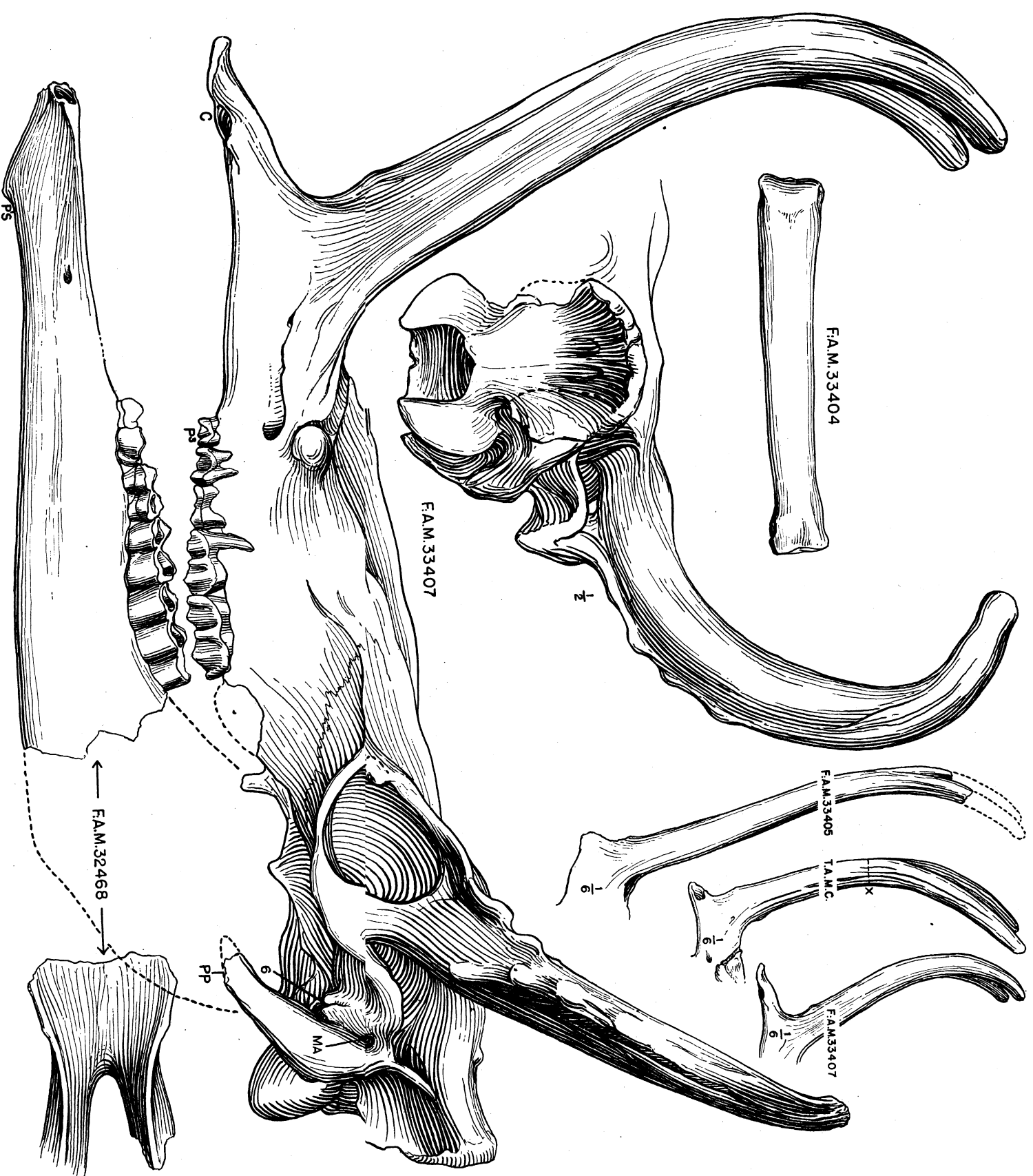


Fig. 61. F.A.M. 33407, 33405, 32468 and 33404 (3d metacarpal), *Synhelocerus tricornutus* Stirton, rel., from Clarendon, Texas.
T.A.M.C., *Prosynhelocerus francisi*, subgenotype in part, from San Jacinto County, Texas.
Views of skull, mandible and 3d metacarpal $\times \frac{1}{2}$; rostral horns $\times \frac{1}{2}$; MA, auditory meatus; PP, paracarpal process; PS, posterior border symphysis; X, point where horn is cut off on Fig. 60; C, glenoid foramina. (See also Figs. 62 [F.A.M. 33407]; 2, 2A, 60, 62, 63 [T.A.M.C.]; and pages 604-606.)

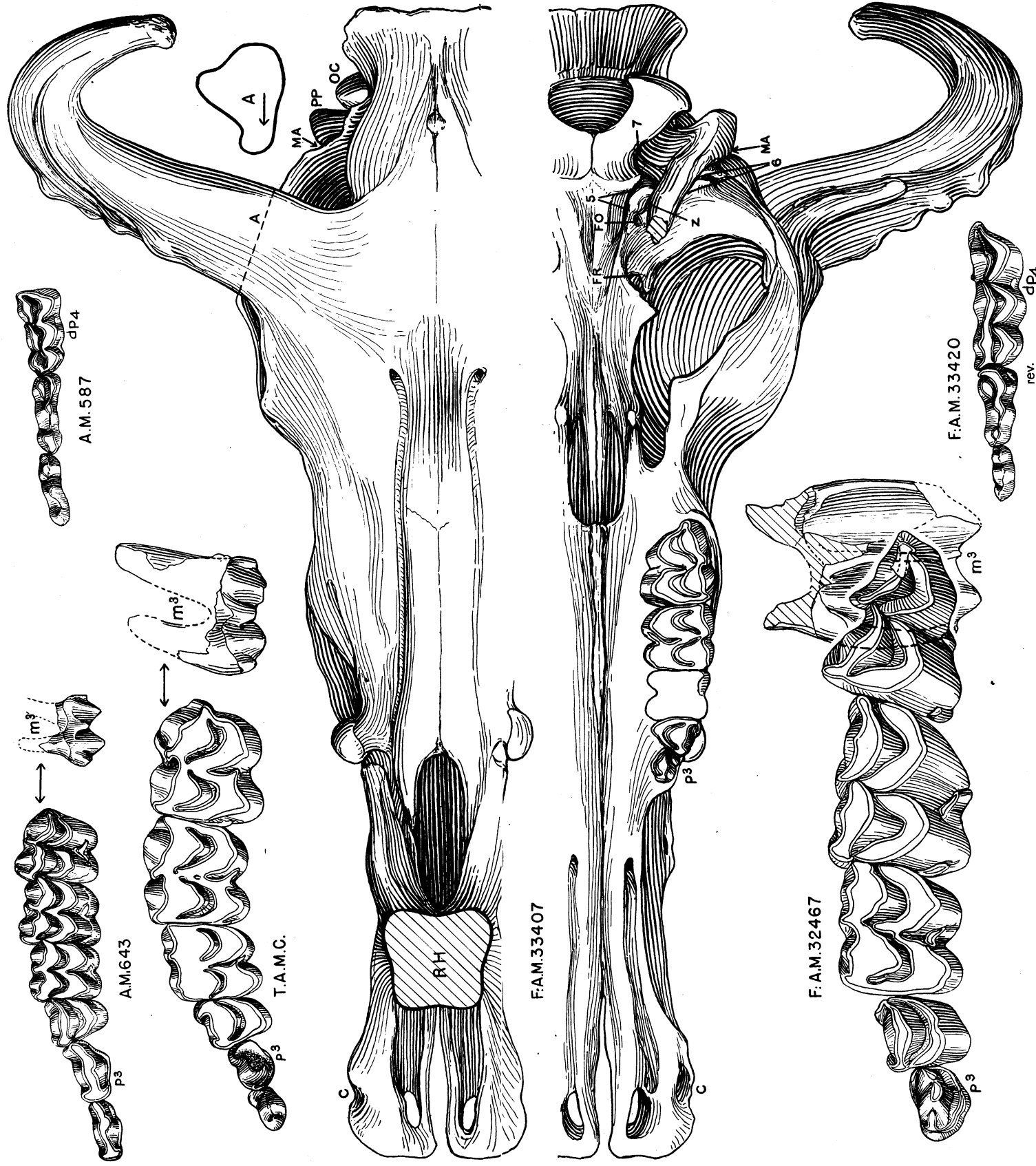


FIG. 62. A.M. 643 and 587, *Protoceras celer* Marsh, ref., from South Dakota.

T.A.M.C., *Prosynthetoceras francisi*, subgenotype in part, from San Jacinto County, Texas.

F.A.M. 33407, 32467 and 33420 (rev.), *Synthetoceras tricornatus* Stirton, ref., from Clarendon, Texas.

Dorsal and palatal views of skull $\times 1$; lateral and occlusal views of teeth $\times 1$. A, cross section of horn; FO, foramen ovale; FR, foramen rotundum; MA, auditory meatus; OC, occipital condyle; PP, paroccipital process; RH, rostral horn; Z, depression for tympanohyal; 5, lacerated foramina; 6, glenoid foramina; 7, condylar foramen. (See also Figs. 60, 63 [A.M. 643]; 2, 2A, 60, 61, 63 [T.A.M.C.]; 61 [F.A.M. 33407]; and pages 612-611, 606-604.)

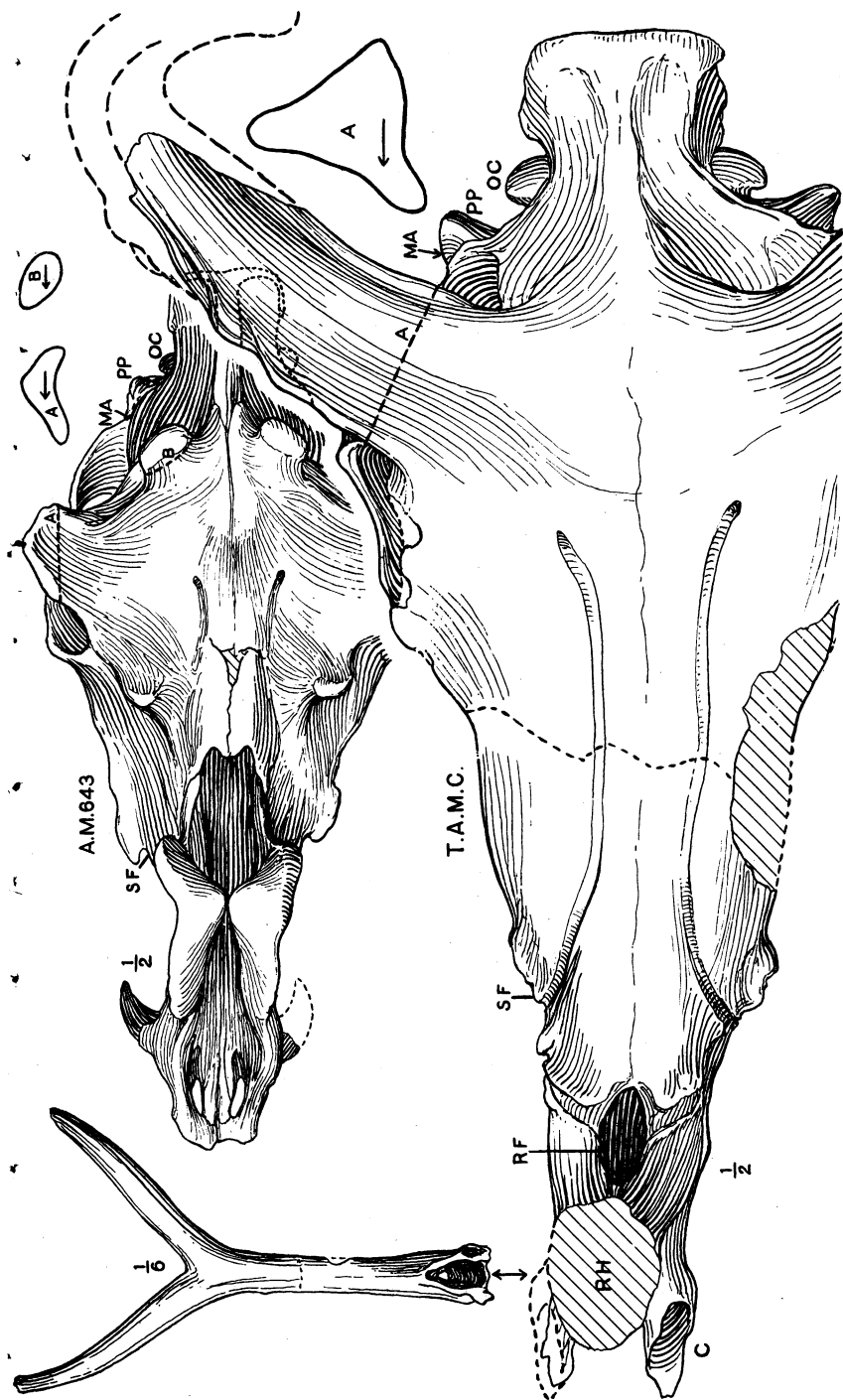


FIG. 63. A.M.643, *Protoceras celer* Marsh, ref., from South Dakota.

T.A.M.C., *Prosyntheloceras francisi*, subgenotype, from San Jacinto County, Texas.

Dorsal views of skulls $\times \frac{1}{2}$; anterior view of rostral horn $\times \frac{1}{4}$. A, B, cross sections of horns; MA, auditory meatus; OC, occipital condyle; PP, paroccipital process; RF, rostral foramen; RH, rostral horn; SF, suborbital foramen. (See also Figs. 60, 62 [A.M.643]; 2A, 60-62 [T.A.M.C.]; and pages 612, 606.)

Detailed Lists of Types, Referred Specimens, and Synonymy

Total available specimens, 54: *Synthetoceras*, 20; *Prosynthetoceras*, 3; *Syndyoceras*, 2; *Paratoceras*, 2; *Protoceras* (and *Calops*), 26; *Pseudoprotoceras*, 1.

SUBFAMILY 1.—SYNTHETOCERATINÆ

I, SYNTHETOCERAS STIRTON AND II, PROSYNTHETOCERAS, NEW SUBGENUS

Reconstruction, Figure 59A

The genus and genotypic species, *S. tricornatus*, rests on a crushed skull collected in the vicinity of Clarendon, Texas, by R. A. Stirton in 1931. The dentition has heretofore been unknown. A very beautifully preserved skull and other remains lately secured at the type locality afford welcome evidence as to certain characters of the cranium and dentition. The particular skull (Figs. 61, 62) is of a considerably smaller individual than the majority of the referred remains, which approximate the type in size (see measurement table, p. 606). The specimen may represent a female. The genus is noteworthy for the great forked horn that rises from near the tip of the muzzle. The skull otherwise indicates a very large and highly specialized *Protoceras*. The rostral horn evidently was derived through union of maxillary processes such as occur in the White River genus. The unobstructed nasal passage through the horn base has an opening dorsally and behind the horn. The paired frontal horns are of triangular basal cross section and situated quite posterior to the orbits. They seem to represent enlarged derivatives of the postorbital processes of *Protoceras*. The arrangement (see Figs. 2A, 62) of the paroccipital, mastoid and auditory area is peculiar to the two genera. Through the posterior position of the paired horns the cranium has the false appearance of being foreshortened. The genus differs from *Protoceras* in the elongation of the muzzle, loss of p_1^1 and greatly reduced premolars. Stirton has observed foramina in the rostral horn on the lateral face below the fork and at the base, giving access to channels within the horn. Diagonally backwardly-passing surface channels connect the dorsal orifice posterior to the horn with the infra-orbital foramina, and a second pair of surface grooves pass from the latter to the supra-orbital foramina. The skull is noteworthy for its elongation and slenderness, the prominence of the large and posteriorly placed orbits, the wide flare of the premaxillæ, the canals running posteriorly from the incisive foramina, the deeply indented posterior palate, the long, slender paroccipitals, the small uninflated bullæ, the slight sagittal crest and the development of the temporal crests and strongly produced inion. Marked tuberosities occur on the anterior and inferior base of the paired horns and above the infra-orbital foramina. This

foramen lies just below the posterior corner of the postrostral opening. The C/ alveoli are small. A questioned and much smaller species, (?) *S. rileyi*, n.sp., is described from the southeast portion of the state.

The subgenotypic species, *Prosynthetoceras francisi*, is based on a cranium from southeastern Texas, which differs from the genus proper in its smaller size, notably smaller and shorter-crowned teeth, the retention of p^2 and the prominence of the C/ alveolus. A partial mandible from Sioux County, Nebraska, is made the type of a distinct species, *P. siouxensis*, and a rostral horn from Dawes County is indicated as a subspecies of the latter.

Four species and one subspecies of the genus and subgenus are recognized:

- (1) *Synthetoceras tricornatus* Stirton, genotypic species, from Donley County, Texas.

GENOTYPE.—Skull, U.C.31520.

- (1a) (?) *Synthetoceras rileyi*, n.sp., from Walker County, Texas.

TYPE.—Partial mandible, F:A.M.34181. This paper, *Fig. 66*.

- (2) *Prosynthetoceras francisi*, n.subg. and sp., from vicinity of Coldspring, San Jacinto County, Texas.

SUBGENOTYPE.—Skull, T.A.M.C. This paper, *Figs. 2, 2A, 60, 61, 62, 63*.

- (3) *Prosynthetoceras siouxensis*, n.sp., from Sioux County, Nebraska.

TYPE.—Left ramus, A.M.17344. Figured by Matthew, 1918, *Fig. 20*.

- (3a) *Prosynthetoceras siouxensis dawesensis*, n.subsp., from Dawes County, Nebraska.

TYPE.—Rostral horn, F:B:A.M.34022. This paper, *Fig. 2C*.

- (1) *Synthetoceras tricornatus* Stirton, genotypic species

From the Clarendon of Texas

Synthetoceras tricornatus STIRTON, 1932, Univ. Cal. Pub. Bull. Dept. Geol. Sci., XXI, p. 147, Figs. 1-3, and Pls. VI-XI.

GENOTYPE.—Skull with backwardly and inwardly curving paired frontal, and single median biforked nasal horns, m^2 - m^3 , and alveoli of m^1 -? p^2 .

U.C.31520
[A.M. cast]

Figured by Stirton, 1932,
Figs. 1-3, and Pls. VI-XI.

REFERRED FROM THE VICINITY OF THE TYPE.—

Four crania or partial crania:

Beautifully preserved skull with rostral and orbital horns, and dentition. (w) F:A.M.33407 This paper, *Figs. 61, 62.*

B.L..... = 395 mm.

Premaxilla-occipital condyle, incl..... = 443

Width over orbits..... = 138

See measurement table, page 606.

Crushed cranium with paired orbital and forked rostral horns, left m^2 - m^3 . (w+) F:A.M.33400 Transferred to the University of Nebraska.

(Cranium as large but horns slighter than in the type specimen. Portion of right side of specimen missing. The three horns, muzzle, left orbit and condyles well preserved.)

Disintegrated skull with left and part of right orbital horn, rostral horn with left fork missing, and p^2 - m^3 of both sides. (w) F:A.M.33406

Posterior portion of cranium with right and base of left orbital horn, and palatal area with rostral horn, forks broken, and p^2 - m^3 of both sides. (M+) F:A.M.33405 This paper, *Fig. 61.*

Two maxillary specimens:

Palate with p^2 - m^3 . (M+) F:A.M.32467 This paper, *Fig. 62.*

(Base of rostral horn and outline of nasal opening, supra-orbital foramen and alveolar troughs preserved. Ms / tall with anterior and median basal projections; ps / reduced; p^2 lost; p^3 peculiarly formed, inner loph low, unnotched; styles tending to meet.)

Right immature maxilla with dp^2 - dp^4 and m^1 - m^3 . F:A.M.32467A

Six mandibular specimens:

Left ramus with part of symphysis and p_2 - m_3 . (M+) F:A.M.32464 This paper, *Fig. 65.*

Approximates in size the type skull (as seen in cast). Incisive border broadly flared, inferior posterior symphysis hollowed, diastema moderate, p_1 - p_2 lost, p_3 and especially p_4 reduced, m_3 anteroposteriorly elongate and tall-crowned.

Partial mandible with symphysis and left p_2 alveolus- m_3 . (w)	F:A.M. 32468 <i>Fig. 61</i>	Partial left ramus with diastema, p_3 - m_3 . (w+++) (Transferred to the University of Nebraska.)	F:A.M. 33402
Crushed mandible with I_2 - I_3 and p_3 - m_3 . (w++)	32465	Left ramus with diastema, I_3 root and p_4 (br.)- m_3 . (w)	33408
Mandible with symphysis and p_3 - m_3 . (w++) (Slightly largest specimen.)	33401		

Two immature mandibular rami:

Right ramus with symphysis and dp_2 - dp_4 .	33420 <i>Fig. 62</i>	Right ramus with symphysis and dp_2 - dp_4 .	33421
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QUESTIONABLY REFERRED.—

Right radius, 247 mm., and ulna.	33410	Left radius and ulna.	33410B
Left radius with proximal and distal portions of ulna.	33410A	Two detached left third metacarpi. (Length = 145-150 mm.)	33403, 33404 <i>Fig. 61</i>

(1a) (?)*Synthetoceras rileyi*, new species

From the Vicinity of Huntsville, Walker County, Texas, 1936

(Premolars less reduced)

TYPE.—Right ramus with p_2 - m_3 and left m_1 - m_3 . (M++)	F:A.M. 34181	Collected by Claude Riley. This paper, <i>Fig. 66</i> .
p_2 - p_4 = 26, p_3 - p_4 = 19, m_3 = 21, p_2 - m_3 = 76.8 mm. (Not included in specimen count.)		

(2) *Prosynthetoceras francisi*, new subgenus and species

From the Vicinity of Coldspring, Texas, 1935

The type cranium (Figs. 2, 2A, 60-63), as noted above, differs from the Donley County crania in its considerably smaller size and notably smaller and shorter-crowned dentition and retained p^2 . What evidently is the alveolus of an enlarged canine occurs at the anterior base of the rostral horn. The cranial characters are better shown than in several of the Clarendon skulls. Lacrimal vacuities, as in the case of *Protoceras*, are absent. The inverted U-shaped supra-occipital area, the peculiar paroccipital processes and peculiarly constricted bullae are well shown. The paired postorbital horns are broken; the rostral horn is proportionately heavy and long-forked. A right ramus from San Jacinto County (F:A.M. 34180, *Fig. 66*), with symphysis, no trace of p_2 , greatly reduced p_3 - p_4 and m_1 - m_3 of approximately the size of the type specimen, is tentatively referred to the same. (p_3 - p_4 = 17.7, m_3 = 28 mm.)

SUBGENOTYPE.—Skull with C/
alveolus, p²-m³, rostral
horn and bases of paired
horns. (M+)

T.A.M.C.

This paper, *Figs. 2, 2A, 60,*
61, 62, 63.

Collected by Claude Riley,
Mark Francis Collection.

REFERRED.—Right ramus, F:A.M.34180; right maxilla, 34182. (Not counted.)

	<i>Synthetoceras tricornatus</i>				<i>Prosyntho- ceras francis</i>	<i>Parato- ceras macadamai</i>
	Genotype	Referred			Subgenotype	Genotype
	[A.M. cast] U.C. 31520	F:A.M. 33400	F:A.M. 33406	F:A.M. 33407	T.A.M.C.	F:A.M. 32457
Foramen magnum to anterior face of rostral horn.....	mm. 345	mm. ((375))	mm. ((360)) -((330))	mm. 335	mm. 300	mm.
Vertex to anterior face of rostral horn.....	407	((400))	-((400))	390	(345)	
Width condyles.....	74	84	65-(70)	73	70	
Rostral horn:						
Height to fork, verti- cal above palate...	375	235	(380)- ((315))	245	((250))	
Total height on ant. curve above palate	510	380	((485))- ((420))	330	((450))	
Orbital horn:						
Length on outer curve	350	270	((280))- ((260))	240		
Greatest spread.....	370	((260))		360		
Anteroposterior distance between rostral and paired horns.....	230	((240))	((220))- ((200))	210	180	
Series p ³ -m ⁴ (F:A.M.32467).....	(101)	((105))	114-101 117	101	75	
P ² -m ³					85	
Ramus, p ₃ -m ₃ inclusive				32464 115	F:A.M.34180 80	81
Ramus, p ₂ -m ₂						(96)

	<i>Synthetoceras tricornatus</i>	<i>Prosynthe- toceras siouzensis</i>	<i>Syndyoceras cooki</i>	<i>Protoceras celer</i>	
	Referred	Type	Genotype	Referred	
	F:A.M.33407	A.M.17344	N.S.M.4-7-05	A.M.1228-643	A.M.1220-N.M.6725
Tip of premax. to anterior notch of foramen mag- num.....	395		285 ¹	((216))-214	((203))-((190))
Width of condyles.....	73			((41))- 38	43 - ((34))
Length p ² -m ³ in- clusive.....	101		96 ¹	((81))- 69	84 - 72
	F:A.M.32465				A.M.1236
Incisive border to m ₃ inclusive....	250	215	179		(132)
Length p ₃ -m ₃ in- clusive.....		110	93		83
Length p ₂ -m ₂ in- clusive.....	110	101	81		72

() approximate; (()) estimated.

¹ And length metatarsus = 130 mm.; communicated by E. H. Barbour, 1934

(3) *Prosynthetoceras siouxensis*, new species

From Sioux County, Nebraska

The type mandibular ramus in general size and reduction of the premolars resembles the Clarendon rami. The diastema tends to be less elongate and the tooth crowns apparently shorter than in the latter.

(?) *Cranioceras unicornis* MATTHEW, referred MATTHEW, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, p. 224, Fig. 20.

TYPE.—Left mandibular ramus with alveoli of three incisors and incisiform canine, unbroken diastema and p_2-m_3 .	A.M.17344	1916. Figured by Matthew, 1918, Fig. 20 (under A.M.17144).
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Incisive border broadly flared, alveoli of I_1-I_3 and of adjacent incisiform /C, post-/C diastema moderately long, p_2-p_4 notably short and heavy, p_2-p_3 apparently about to be shed, m_1 much worn, m_2 with median column and cingulum, m_3 relatively tall and crown tending to be concave outwardly.

A left ramus with p_4-m_3 (P.U.12106), referred to (?) *Neotragocerus improvisus* Matthew and Cook by Sinclair (1915), resembles A.M.17344 except in the smaller size of the m_3 .

(3a) *Prosynthetoceras siouxensis dawesensis*, new subspecies

From Observation Quarry, Dawes County, Nebraska

Collected by T. Galusha, 1936

TYPE.—Rostral horn.	F:B:A.M.34022	This paper, Fig. 2C.
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TENTATIVELY REFERRED.—

Right third metacarpal,	F:B:A.M.34028
131 mm. long.	

(Not included in specimen count.)

SUBFAMILY 2.—SYNDYOCERATINÆ

III. SYNDYOCERAS BARBOUR

From the Lower Miocene

Reconstruction, Figure 59B

The genus rests on the well-preserved genotype in the collection of the University of Nebraska, described by Erwin Hinckley Barbour. The same is characterized by the unreduced premolars, the paired rostral processes united over dorsal foramen, and paired postorbital horncores. The /C is incisiform, the p_1 caniniform. The genotypic and only species is *Syndyoceras cooki* Barbour, from the Harrison of Nebraska.

(1) *Syndyoceras cooki* Barbour, genotypic species

From the Lower Miocene, Sioux County, Nebraska

Syndyoceras cooki BARBOUR, 1905, Nebr. Geol. Surv., II, Pt. 3 (unpaged), Pl. 1; 1906, Science, XXIII, p. 623. SCOTT, 1913, A History of Land Mammals in the Western Hemisphere, p. 404, Fig. 215.

GENOTYPE.—Cranium with mandible and major portion of skeleton.

N.S.M.4-7-05

Morrill Collection.

Figured by Barbour, 1905, Pl. 1; this paper, Fig. 65 (cast of mandible).

TENTATIVELY REFERRED (communicated by Erwin H. Barbour).—

Femur, tibia, twelve to fourteen vertebrae in articulation, and other unprepared parts.

N.S.M.12-9-7-92

Found in large *Dæmonelix* rhizome close to the spot where type specimen was subsequently secured, 20 to 30 feet from Agate Road, 2 mi. from Agate Springs.

SUBFAMILY 3.—PROTOCERATINÆ

Three genera are recognized:

IV. *Paratoceras*, n.g., from the Late Tertiary

V. *Protoceras* (and *Calops*) Marsh, from the Middle Tertiary (U. Oligocene)

VI. *Pseudoprotoceras* Cook, from the Middle Tertiary (L. Oligocene)

IV. PARATOCERAS, NEW GENUS

From the Clarendon of Texas

The genus is based on a mandibular ramus which evidently belonged to a somewhat smaller form, and one with a quite different dentition, from *Synthetoceras*. The closeness of the p_2 to the posterior border of the symphysis, the extreme compression of the premolars, the antero-posterior elongation of p_3 relative to p_4 and the low molar crowns at once recall the White River genus *Protoceras*. The p_2 - m_3 distance actually but slightly exceeds that of a large individual of the latter. The unique type and referred specimens were collected, with the other Clarendon remains, by the John Lynch party on the MacAdams Ranch, through the helpful coöperation of the owners.

(1) *Paratoceras macadamsi*, new genus and species

From the Clarendon, Texas

GENOTYPE.—Right ramus with F:A.M.32457 This paper, *Fig. 65*.
 p_2 - m_3 and posterior border
of symphysis. (M+)

<i>Paratoceras</i> <i>macadamsi</i> , genotype	<i>Protoceras</i> <i>celer</i> , ref.	
F:A.M.32457	A.M.1220	A.M.1236
p_2 - p_4 = 44.5 mm.	44.5 mm.	38. mm.
p_2 - m_3 = (96)		82.

REFERRED.—

Left ramus with p_4 - m_3 . F:A.M.33409
(M)

V. *PROTOCERAS* MARSH

From the Upper White River, South Dakota

Reconstruction, Figure 59c

Protoceras, of the White River Oligocene, is relatively well represented by skulls and jaws in the collections of several institutions. Marsh (1891-1897) referred the South Dakota remains of the Yale collection to two genera and five species. The material in the American Museum, described by Wortman and Osborn (1892), includes skulls of males and females. The specimens show a range in the size of the dentitions which is not dependent on sex, and a great difference in the development of the skull protuberances of the mature males. Many of the observed differences may be those of individual variation. Pending a much to be desired detailed study of all the material in the several collections, the described genera and species, types and more important references are briefly listed below.

Protoceras is characterized by the development, particularly in the males, of bony protuberances on the maxillæ, parietals and frontals, these being rudimentary in the female. The closed orbits are posteriorly placed; the bullæ are uninflated; and the angle of the lower jaw is rounded and without hook-like processes. Marsh observed the striking parallelism between *Protoceras* and *Dinoceras* in the protuberances,

enlarged upper canines and absence of upper incisors. The tips of the abbreviated nasals lie only slightly anterior to the deeply incised edge of the posterior palate. A foramen may occupy the middle of the fronto-nasal suture. The unroofed nasal cavity seems indicative of some form of proboscis. The C/ was enlarged; the p_1^i were small, double-rooted and detached; the succeeding ps were large, the /ps compressed laterally; and the molars brachyodont. The ulna and radius were coössified and the fibula completely reduced. The cuboid and navicular already were united. The manus had four complete, and the pes two ununited, digits.

The genus and questioned subgenus and five species and types, as described by Marsh, the referred remains in the American Museum collection and the synonymy are given below:

- (1) *Protoceras celer* Marsh, genotypic species.

GENOTYPE.—Female skull, Y.P.M. collection.

- (2) *Protoceras comptus* Marsh.

TYPE.—Immature (?)female skull, Y.P.M. collection.

- (3) *Protoceras nasutus* Marsh.

TYPE.—Male skull, Y.P.M. collection.

- (4) *P. (Calops) cristatus* Marsh.

TYPE.—Female skull, Y.P.M. collection.

- (5) *P. (Calops) consors* Marsh.

TYPE.—Female skull, Y.P.M. collection.

- (1) *Protoceras celer* Marsh, genotypic species

From the *Protoceras* Beds, South Dakota

Protoceras celer MARSH, 1891, Amer. Journ. Sci. (3), XLI, p. 81; 1893, *ibid.* (3), XLVI, p. 407, Pl. VII; 1897, *ibid.* (4), IV, p. 165, Pls. II–V; VI, Fig. 1; VII, Figs. 3, 4; and Text-Figs. 4, 6, 7. OSBORN AND WORTMAN, 1892, Bull. Amer. Mus. Nat. Hist., IV, p. 353, Text-Figs. 1–6. SCOTT, 1899, Trans. Wagner Free Inst. Sci. Phila., VI, p. 112. MATTHEW, 1909, Bull. No. 361, U. S. Geol. Surv., p. 109. SCOTT, 1913, A History of Land Mammals in the Western Hemisphere, p. 406, Fig. 216. O'HARRA, 1920, Bull. S. Dak. School of Mines, XIII, p. 129, Pls. XXIII, XLIII, XLIV, Text-Fig. 66.

GENOTYPE.—Female skull, Y.P.M. Coll. Figured by Marsh, 1893, Pl. VII; 1897, Text-Figs. 6, 7, and Pl. VII, Figs. 3, 4 (of brain casts).
premaxillary area missing.

REFERRED BY MARSH, 1897.—

Male skull and jaw. Y.P.M. Coll. Figured by Marsh, 1897, Pls. II-V; VI, Fig. 1; and Text-Fig. 4.

Etc. ?female skulls.

REFERRED BY OSBORN AND WORTMAN (1892), AMERICAN MUSEUM SPECIMENS FROM CHEYENNE RIVER, SOUTH DAKOTA:—

Including larger and smaller individuals:

Large:

		A.M.
Male skull. B.L. = ((225)) mm.....	(M)	1228
(Narrowness of rostrals possibly because of adolescence.)		
Female skull, jaws and right humeri (2) (see listed below).....	(W++)	1220
(Much the largest-toothed specimen of the series.)	Fig. 2A	

Moderate:

Female skull, jaws and skeleton (see listed below).....	(W)	1236
	Fig. 65	
	(ramus)	
Female skull. Figured by Osborn and Wortman, 1892, Text-Fig. 3.....	(W+++)	645
Female skull.....	(M++)	1224
(Cingula exceptionally developed on molars.)		
Back of skull, parietal horns, upper molars, astragalus and calcaneum.....		640
Skull fragments, cervicals, foreleg, etc. (see listed below).....		1227
Anterior upper and lower jaws, I ₁ -I ₂ , small /C incisiform...	(-M)	1237

Immature:

Partial skull.....		584
Immature maxilla with dp ³ -m ²		642
Immature mandible.....	Fig. 62	587
Immature ramus.....		1234
Immature right ramus.....		1226

Smaller individuals with smaller teeth:

Two uncrushed specimens (A.M.643 and N.M.6725) each exhibit an inter-nasofrontal foramen and broad rostral flanges. The specimens possibly represent *P. nasutus* Marsh.

Male skull. (p ² proportionately small.) B.L. = (200) mm.		A.M.
Figured by Osborn and Wortman, 1892, Text-Figs. 1, 2, 4;	(M+)	643
this paper.....		Figs. 60, 62, 63
		N.M.
Female skull and mandible. B.L. = ((185)) mm.....	(M)	6725
		A.M.
Male skull.....	(M++)	1223
Female skull.....	(W)	1229
Female skull, crushed.....		641

Limb elements:

Composite skeleton: Partial scapula, both humeri (partially restored), parts of ulno-radial, partial left carpus, left metacarpus (3d = 88 mm.), etc. phalanges, both femora, right and partial left tibia, both tarsi, left (102 mm.) and partial right metatarsus, etc. phalanges, ribs, vertebrae and pelvis. (See female skull and jaws above. This paper, <i>Fig. 65</i> [ramus].).....		1236
Right and partial left humerus, both ulno-radial, partial carpi, both metacarpi (left 3d = 88 mm.), etc. phalanges, left femur, patella, partial tibia, tarsus, metatarsus (101 mm.), etc. phalanges. (See skull fragments above.) Resembles specimen figured by Osborn and Wortman, 1892, Figs. 5 and 6 (manus and pes).....	<i>Fig. 60</i>	1227
Partial tibia, both tarsi, both metatarsi (left = 103 mm.) and all phalanges.....		644
Two right humeri. (Listed above.).....		1220
Pelvis and metapodials. (Associated skull not located in 1900.).....		1219

(2) *Protoceras comptus* Marsh

From the *Protoceras* Beds, South Dakota

Protoceras comptus MARSH, 1894, Amer. Journ. Sci. (3), XLVIII, p. 93; 1897, *ibid.* (4), IV, p. 172, Pl. VI, Fig. 2. MATTHEW, 1909, Bull. No. 361, U. S. Geol. Surv., p. 109.

TYPE.—Immature and possibly female skull with C/, Y.P.M. Coll. Figured by Marsh, 1897, Pl. vi, Fig. 2 (palatal view).
 p^1 , dp^2 - m^2 (erupting).

[Maxillary plates not elevated along sides of nasals, parietal ridges with incipient rugosity. Skull length = 8 inches (203.2 mm.).]

(3) *Protoceras nasutus* Marsh

From the *Protoceras* Beds, South Dakota

Protoceras nasutus MARSH, 1897, Amer. Journ. Sci. (4), IV, p. 168, Text-Fig. 5.
 MATTHEW, 1909, Bull. No. 361, U. S. Geol. Surv., p. 109.

TYPE.—Male partial skull. Y.P.M. Coll. Figured by Marsh, 1897, Text-Fig. 5 (lateral of anterior skull).

(Summits of maxillary horn-cores are oval versus triangular in cross section.)

VA. P. (CALOPS) MARSH

(4) *P. (Calops) cristatus* Marsh

From the *Protoceras* Beds, South Dakota

Calops cristatus MARSH, 1894, Amer. Journ. Sci. (3), XLVIII, pp. 94, 237; 1897, ibid. (4), IV, p. 174. MATTHEW, 1909, Bull. No. 361, U. S. Geol. Surv., p. 109.

TYPE.—Female skull, said to be fairly well preserved. Y.P.M. Coll.

[Parietal ridges elevated into distinct crests and without horns.

According to Marsh: Skull length = approximately 6 inches (152.4 mm.); p^2 - m^2 = $2\frac{1}{2}$ inches (63.5 mm.).]

(5) *P. (Calops) consors* Marsh

From the *Protoceras* Beds, South Dakota

Calops consors MARSH, 1897, Amer. Journ. Sci. (4), IV, p. 175, Pl. vii, Figs. 1, 2.
 MATTHEW, 1909, Bull. No. 361, U. S. Geol. Surv., p. 109.

TYPE.—Female skull. Y.P.M. Coll. Figured by Marsh, 1897, Pl. vii, Figs. 1 and 2.
 (Posterior edge m^2 opposite mid-orbit.)

VI. PSEUDOPROTCERAS COOK

The partial skull of the genotype is described as "... already having progressed too far in certain directions to be ancestral to *Protoceras*; seemingly representing a nearly related branch, or race ... While brachyodont, the dentition is more nearly hypsodont than is the case in the more recent *Protoceras* of the Upper Oligocene... This species is much smaller than *Protoceras*... The recession of the anterior nares is remarkable, extending slightly back of the anterior rim of the orbits, though the nasal bones are relatively longer than in *Protoceras celer* Marsh."

(6) *Pseudoprotoceras longinaris* Cook

From Lower Chadron Beds, Nebraska

Pseudoprotoceras longinaris Cook, 1934, Amer. Mid. Nat., XV, No. 2, p. 149, Pl. III, Fig. 1.

GENOTYPE.—Anterior portion of cranium, and astragalus and navicular.

H.C.507

From 9 miles north of Crawford, Nebraska.

Figured by Cook, 1934, Pl. III, Fig. 1.

TABLE XV
PROTCERATINI COMPARATIVE LIMB MEASUREMENTS AND RATIOS

	Locality	Collection No.	Radius	3d Metacarpal	Femur	Tibia	3d Metatarsal	See Figure
			mm.	mm.	mm.	mm.	mm.	
<i>Synthetoceras tricornatus</i> , questionably referred..	Clarendon, Tex.	Unassoc., p. 605	265 247	150 145				
<i>Syndyoceras cooki</i> , genotype (part).....	Sioux Co., Nebr.	N.S.M.4-7-05 ¹			222	242	130	
<i>Protoceras celer</i> , ref.	S. Dak.	A.M.1227 ²	140	89	188	((192))		60
".....	"	A.M.646					100	

(()) estimated measurement.

¹ N.S.M.4-7-05, femur/tibia = 92%; 3d metatarsal/tibia = 54%.

² A.M.1227, 3d metacarpal/radius = 64%; radius/tibia = ((73))%; femur/tibia = ((86))%.

FIGS. 64 AND 65. *Protoceratid* and *Hypertragulid* skulls or mandibular rami, lateral views (and two occlusal) compared.

× 1 (excepting A.M.1236, N.S.M.4-7-05 and lateral views of F:A.M.32457 and 32464 × $\frac{1}{2}$). PS, posterior border symphysis.

FIG. 64. C.M.883 (in part), *Hypisodus alacer* Troxell, ref., from Sioux County, Nebraska.

(See page 647.)

A.M.9354, *Hypisodus minimus* Cope, ref., from Pawnee Buttes, Colorado.

(See page 646.)

F:A.M.31525, *Nanotragulus loomisi* Lull, ref., from Muddy Creek, Lusk, Wyoming. (The bulla is supplied from F:A.M.31524 and the teeth partly from 31523; the position of p^1 is after Schlaikjer, 1935, Pl. xli, Fig. 4.)

(See page 642.)

A.M.1347a, *Leptomeryx minimus*, n.sp., type, from the *Protoceras* Beds, South Dakota.

(See page 630.)

A.M.13821, *Nanotragulus lulli*, n.sp., type, from the Lower Rosebud, South Dakota.

(See page 643.)

A.M.1341, *Hypertragulus calcaratus*, var., from Cheyenne River, South Dakota.

(See page 635.)

A.M.7918, *Hypertragulus hesperius* Hay, type, from the John Day, Oregon.

(See page 636.)

F:A.M.31534, *Nanotragulus ordinatus*, var., rev., from Keeline, Wyoming.

(See page 641.)

A.M.13011, *Nanotragulus ordinatus* (Matthew), type, from the Lower Rosebud, Porcupine Creek, South Dakota.

(See page 641.)

FIG. 65. A.M.11870, *Leptomeryx evansi* Leidy, ref., from Cheyenne River, South Dakota. (Premaxillary area after F.M. P12554, as communicated by E. S. Riggs.)

(See page 627.)

A.M.13784, *Nanotragulus albanensis*, n.sp., type, rev., from the Lower Harrison, Sioux County, Nebraska.

(See page 640.)

A.M.1332, *Leptomeryx obliquidens* Lull, ref., from the *Protoceras* Beds, South Dakota.

(See also Fig. 67 and page 625.)

C.M.809b, (?) *Eotylopus profectus* Matthew, ref., rev., from the Pipestone Beds, Montana.

(See page 653.)

A.M.1236, *Protoceras celer* Marsh, ref., female, from Cheyenne River, South Dakota.

(See page 611.)

F:A.M.32457, *Paratoceras macadamsi*, n.g. and sp., genotype, rev., from Clarendon, Texas.

(See page 609.)

F:A.M.32464, *Synthetoceras tricornatus* Stirton, ref., from Clarendon, Texas.

(See page 604.)

N.S.M.4-7-05, *Syndyoceras cooki* Barbour, genotype (in part), after cast, from the Lower Miocene, Sioux County, Nebraska.

(See page 608.)

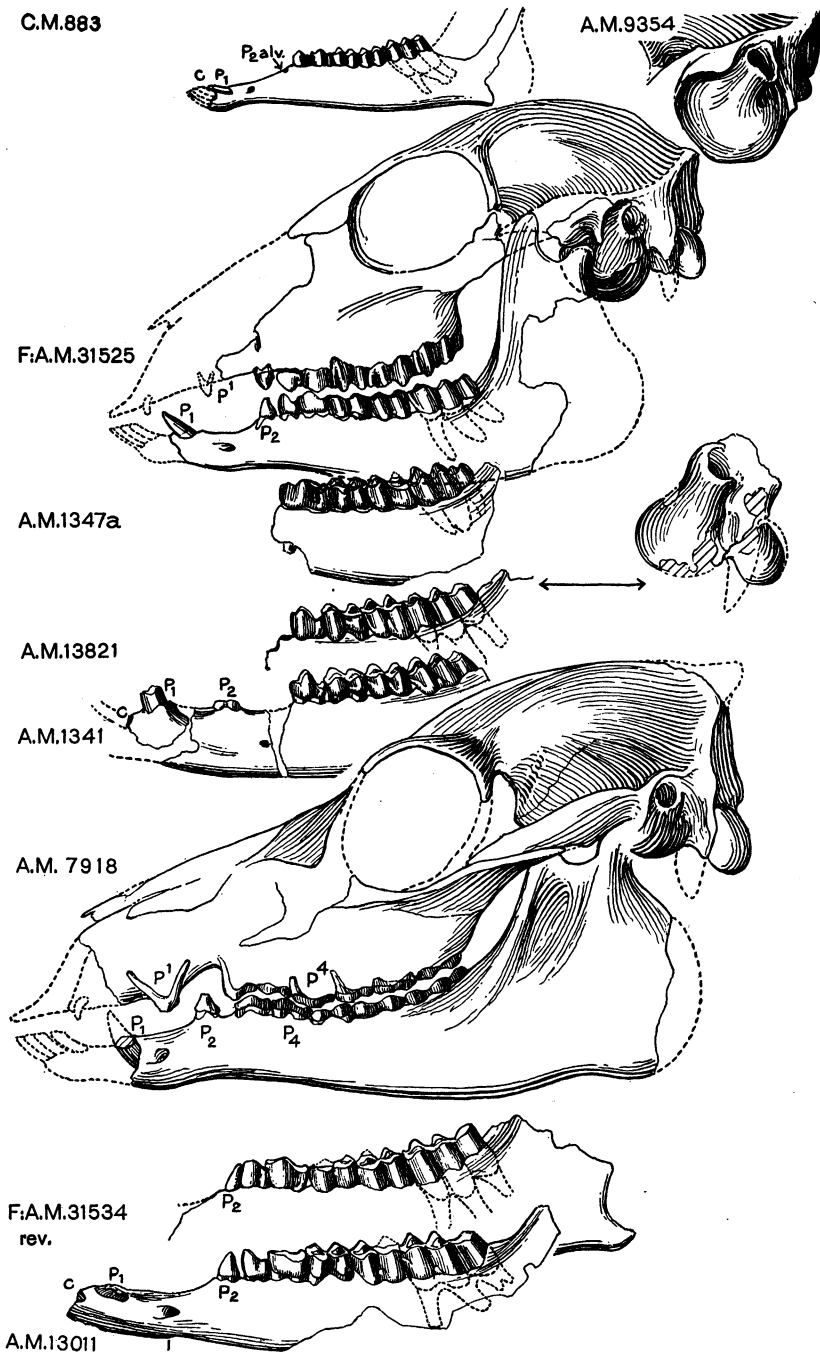


FIG. 64. *Hypisodus* Cope (C.M.883 and A.M.9354), *Nanotragulus* Lull, *Leptomeryx* Leidy (A.M.1347a) and *Hypertragulus* Cope (A.M.1341 and 7918), skulls or mandibular rami from Nebraska, Colorado, Wyoming, [South Dakota and Oregon, lateral views compared.
 X 1. (See legend, page 615.)

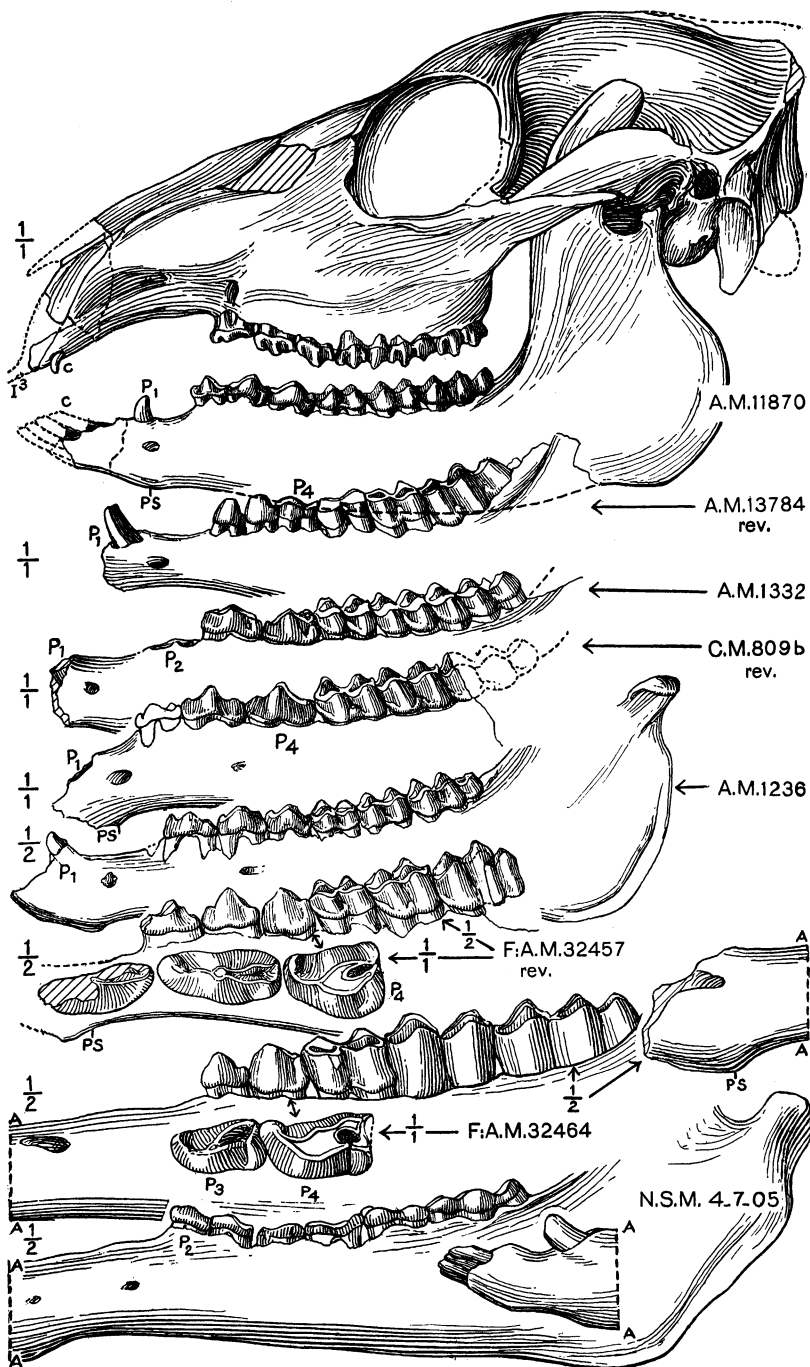


FIG. 65. *Leptomeryx* Leidy, *Nanotragulus* Lull (A.M.13784), (?)*Eotylpus* Matthew (C.M.809b), *Protoceras* Marsh (A.M.1236) and *Syndyoceras* Barbour (N.S.M.4-7-05), from the Middle Tertiary; *Paratoceras*, n.g. (F:A.M.32457) and *Synthetoceras* Stirton (F:A.M.32464), from the Late Tertiary, skull or mandibular rami, lateral views (and two occlusal) compared.

× 1 (excepting A.M.1236, N.S.M.4-7-05 and lateral views of F:A.M.32457 and 32464 × ½). (See legend, page 615.)

TABLE XVI

HYPERTRAGULID GENERA, SUBGENERA AND SPECIES OF THE AMERICAN MIDDLE TERTIARY—OCCURRENCE AND TOTALS OF AVAILABLE SPECIMENS
(Roman and arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in () from type, and in [] from other than type area for the particular species.)

	Genus Number	Harrison, Nebr.	Lusk, Wyo. (and *Rosebud, S. Dak.)	John Day, Oreg.	Bridgeport, Morrill Co., Nebr.	Cedar Cr., Logan Co., Colo.	Squaw Cr. (and *Bad- land Cr.), Sioux Co., Nebr.	Hellgate R. (and *Pipe- stone Beds), Mont.	<i>Protoceras</i> (* <i>Oreodon</i> and † <i>Titanotherium</i>) Beds, White R., S. Dak.	Saskatchewan, Canada	Specimen Count
A.—LEPTOMERYCINI											
<i>Leptomeryx</i> Leidy	I					[4b] [5b]	*[4a] [5a]	(2) *1? [2a] * [4c]	(1) * (4) (5)	(3) ? (6) (6a) (6b)	400
<i>Heteromeryx</i> Matthew	II								† (1)		1
B.—HYPERTRAGULINI											
<i>Hypertragulus</i> Cope	III			(2) (2a) (2b) ? (4)	[1b] ? (3)	(1)			[1a] * [1a] ? (5)		311
<i>Nanotragulus</i> Lull	IV	(1)	*(2) [2a] (3) * [3a]								39
Total											751
C.—HYPISODONTINI											
<i>Hypisodus</i> Cope	V	(2)				(1)	* [2]				19
Total											19
Grand Total											770

*, †, refer to localities as shown in column headings.

? , questions the generic or subgeneric reference.

FAMILY V.—HYPERTRAGULIDÆ

(Cope, 1879)

DIVISIONS A.—LEPTOMERYCINI; B.—HYPERTRAGULINI;
AND C.—HYPISODONTINI

Figures 64 and (in part) 2A, 65, 67; Limbs (in part) 25B

DISCUSSION

The Hypertragulidæ of the literature embraces a number of hornless forms from the American Middle Tertiary. The family, as explained in the Introduction, is considered as of the divisions, Leptomerycini, Hypertragulini and Hypisodontini. Additional evidence from the field as to many of the here enumerated forms is much to be desired. The family is interesting in connection with the Pecora of the present report particularly because of previous citations of the included hornless genus *Leptomeryx* as a Cervid ancestor. *Leptomeryx*, with brachyodont dentition and short metacarpals, parallels in degree the Lower Miocene *Pseudoblastomeryx*, in which, however, the p_2^2 - p_3^3 are definitely smaller, the diastema longer, p_1 unretained and the metapodials relatively very elongate. *Hypertragulus* is characterized by its sharp unicuspid p_2 - p_3 and tendency to occurrence of an interpremolar diastema. The diminutive Hypisodontini, in the tall, slender crowns of their cheek teeth, parallel the Antilocapridæ. The Hypertragulids, in the detached p_1^1 and tendency to compressed anterior premolars, are suggestive of the Camelidæ, certain members of which retained short and detached metacarpals.

Cope (1879) placed the genera *Leptomeryx* and *Hypertragulus* in a family, the Hypertragulidæ. "... This family connects the *Tragulidæ* with more typical *Ruminantia*. It differs from that family in the absence of the fibula and the external metapodial bones. From the typical *Ruminantia* or *Pecora*, it differs in the incompleteness of the trochlear keel of the metapodials, and the trenchant character of the premolars, excepting the last." Zittel (1891-1893) includes *Leptomeryx*, *Hypertragulus* and *Hypisodus* in the Leptomerycinæ. Marsh (1891) refers *Protoceras* to a distinct family, the Protoceratidæ. Scott (1899) includes *Protoceras*, *Leptomeryx*, *Hypertragulus* and *Hypisodus* in the Leptomerycidæ. Matthew (1905) "... regards the [Hypertragulid] group as an entirely independent offshoot of the primitive ruminant

stock, without especially near relations to any other group, and without any known descendants in the Miocene or later epochs. The tendency to podial coössification is a marked feature, allying them with *Tragulids* and *Pecora*, and one that never occurs in camels, although these have the metapodial reduction much more advanced. The wide difference in evolution between fore and hind feet separates them from all other groups. The fore foot, however, is not known in *Hypertragulus* and *Hypisodus*... In many respects they are strikingly like the primitive camels, but the resemblance is chiefly in archaic characters and would unquestionably be shared by all primitive ruminants, of no matter what group. The resemblances to *Tragulus* are also marked..." Scott (1913) interprets the *Hypertragulidæ* as an early offshoot of cameline stock referable to the *Tylopoda*. Matthew (1908 and 1929) considers the genus *Leptomeryx* ancestral to certain deer and includes the family in the *Pecora*. Zittel (1923), listing *Blastomeryx* in the *Hypertragulidæ*, places *Protoceras* with the giraffes in the *Pellicornia* and *Hypisodus* with the *Antilocapridæ*.

The subfamily *Hypertragulinæ* consists of the genera *Hypertragulus* and *Nanotragulus*; the *Leptomerycinæ* of the typical genus *Leptomeryx*. The *Leptomerycinæ*, with certain rather Cervid-like characters, induced Matthew (1908) to observe *Leptomeryx* to be "... an extremely primitive, unspecialized genus of pecoran stock ... [which] fulfil[s] ... the theoretical requirements for an ancestor of *Blastomeryx*." In the writer's opinion and as discussed below there would seem to be no very valid reason for placing *Leptomeryx*, as at present known, otherwise than within the *Hypertragulidæ*, though the contemporaneous *Hypertragulus* Cope proper is definitely more camelid than *Leptomeryx*. Relationship between these groups and the eastern *Tragulidæ* proper, Recent *Hyemoschus* Gray and *Tragulus* Brisson, and the Late Tertiary (?) *Dorcatherium* Kaup, is very doubtful. The *Hypisodontinæ* is known alone by the diminutive genus *Hypisodus* of the Oligocene. Unfortunately, examples of the *Hypertragulidæ* subfamilies and genera are largely absent or poorly represented in our new collections, with the exception of three *Nanotragulus* crania associated with jaws and limb elements, collected by Charles Falkenbach (1934) from the Lower Miocene in the vicinity of Lusk, Wyoming. The literature is greatly confused as to the different types and species, their characters and dimensions, and the allocation and distribution of the referred species and specimens. The present tentative résumé of the family is presented only pending a much needed thoroughgoing revision in the light of additional material from the type and other localities.

General Characters (where observable).—Bullæ moderately inflated (versus larger in *Nanotragulus* and large in *Hypisodus*); molars brachyodont (in *Leptomeryx* and *Hypertragulus*—in part) to subhypodont (in *Nanotragulus*) and hypsodont (in *Hypisodus*); C/ apparently small (unknown in *Hypisodus*); /C incisiform; premolars large and somewhat Cervid-formed (in *Leptomeryx*), compressed and tending to be strongly reduced (in *Hypertragulus-Nanotragulus-Hypisodus*); p¹ lost (in *Leptomeryx*) to retained and double-rooted (in *Hypertragulus*); p₁ detached caniniform, and single-rooted. Manus short and with four separate digits (unknown in *Hypertragulus* and *Hypisodus*); pes didactyl with formed to unformed cannon bone (tetradactyl in *Nanotragulus*); radius and ulna coössified (except in *Leptomeryx*—as in *Protoceras*); fibula distally detached (except in *Hypertragulus* and *Hypisodus*); keels of metapodial trochlea confined to palmar surface.

SUMMARY OF HYPERTRAGULIDÆ SPECIMENS

Genus No.		Crania	Maxillæ	Mandibles	Limbs	Total Elements	Assoc. Elements	Total Specimens
	DIVISION A.—HYPERTRAGULINI							
I	<i>Leptomeryx</i> Leidy.....	8	38[7]	341[8]	3[1]	*416	16	*400
II	<i>Heteromeryx</i> Matthew.....	1	[1]		[1]	3	2	1
III	<i>Hypertragulus</i> Cope.....	6	60[6]	256[5]	[2]	324	13	311
IV	<i>Nanotragulus</i> Lull.....	4	7[4]	29[4]	7	47	8	39
	DIVISION B.—HYPISODONTINI							
V	<i>Hypisodus</i> Cope.....	4	12[4]	12[5]	[1]	29	10	19
		23	118	638	14	819	49	770

[] associated; * including 26 etc.

The *Hypertragulidæ* are here tentatively considered under three divisions and subfamilies:

DIVISION A.—LEPTOMERYCINI.

Subfamily 1.—LEPTOMERYCINÆ.

DIVISION B.—HYPERTRAGULINI.

Subfamily 2.—HYPERTRAGULINÆ.

DIVISION C.—HYPISODONTINI.

Subfamily 3.—HYPISODONTINÆ.

The general characters of the three divisions and allocated subfamilies and genera, together with the named species, the types and the synonymy, are briefed in the ensuing pages.

DIVISION A.—LEPTOMERYCINI

Subfamily 1.—*Leptomerycinae*

[LEPTOMERYCIDÆ Scott, 1899 (in part)]

I. *LEPTOMERYX* LEIDY AND

II. *HETEROMERYX* MATTHEW

From the White River Oligocene

Figures (in part) 2A, 64, 65 and 67; Limbs (in part) 25B

Statement

The subfamily includes the genus *Leptomeryx*, genotypic species *L. evansi* Leidy (1853), and the questioned *Heteromeryx* Matthew, typically from the Upper Oligocene of South Dakota. *Leptomeryx* species of larger and smaller size are recognized from the Oligocene of Montana and Saskatchewan, and variable species of intermediate size from South Dakota, Colorado and Nebraska. The genus is not recognized as yet in the Lower Miocene. The seven species and the available and referred remains may be listed for convenience under three size groups. The latter approximately parallel the three size groups of the following subfamily and genus, *Hypertragulus* Cope. (The dimensions of the molars of Size Group I to Size Group III broadly approximate those of Size Group IV to Size Group VII of the Blastomerycini and Merycodontini.)

Characters.— I_1 procumbent and large; (I^3 occasionally retained¹); C/ small, /C incisiform; p^1 apparently absent; p_1 caniniform, single-rooted and detached; diastema long; succeeding premolars long anteroposteriorly, compressed laterally (versus reduced in *Hypertragulus*); molars low-crowned and without "Palæomeryx" fold. The skull exhibits a diamond-shaped prelacrima vacuity; the bullæ are small. The radius and ulna, as the tibia and fibula, are separate; the navicular and cuboid are united; the manus has four short digits, the laterals being small, and the pes a formed cannon bone.

Compared to the Blastomerycini, the detached peg-like p_1 is retained; the p_2^2 , though long anteroposteriorly, are compressed; the p_2 - p_3 inner cusps are less developed; the "Palæomeryx" fold is absent or too

¹ Communicated by E. S. Riggs.

small to be detected; and the limbs are of primitive character. The teeth, as seen in the South Dakota remains (A.M.1345), are only slightly smaller than in *Pseudoblastomeryx advena* (A.M.13014), while the third metatarsal, as seen in a Colorado specimen (A.M.6782), measures 68 mm., versus a metatarsus referred to (?)*P. advena*, smaller var. (A.M.13823), 90 mm. The Colorado third metacarpal (A.M.6782) measures approximately 40 mm., and a Sioux County, Nebraska, third metacarpal (C.M.997) 49 mm., versus in *P. advena* (A.M.13015) 80 mm.

The *Leptomeryx* skull and dentition are not unsuggestive of the much larger *Parablastomeryx gregorii*; the orbits similarly are situated anteriorly, the bullæ small to inflated, the premolars proportionately large, particularly p^2 - p^3 , and the p_4 of Cervid pattern, but the diastemata are shorter-proportioned, a detached p_1 is present, the posterior angle of the ramus is rounded inwardly versus produced downwardly and the metapodials are short and detached versus in *P. gregorii*.

Summary of Named Species

The seven or eight *Leptomeryx* species are:

SIZE GROUP I.

- (1) *Leptomeryx obliquidens* Lull (1922), from the *Protoceras* Beds, South Dakota.

TYPE.—Posterior portion of skull and mandible, Y.P.M.10541.

- (2) *Leptomeryx transmontanus* Douglass (1903), from the Oligocene, Montana.

TYPE.—Partial skull, C.M.726.

- (2a) (?) Var., from the Pipestone Beds, Montana.

EXAMPLE.—Left ramal fragment, A.M.9684.

- (3) *Leptomeryx mammiifer* Cope (1885), from Swift Current Creek, Saskatchewan, Canada.

TYPE.—Ramal fragment, Can. Geol. Surv. Coll.

SIZE GROUP II.

- (4) *Leptomeryx evansi* Leidy (1853), genotypic species, from South Dakota.

GENOTYPE.—Partial skull and jaw fragment, N.M.157.

- (4a, 4b and 4c) *L. evansi*, or vars., from Nebraska; Cedar Creek, Colorado; and Pipestone, Montana.¹

EXAMPLES.—Ramal fragments.

SIZE GROUP III.

- (5) *Leptomeryx minimus*, n.sp., from the *Protoceras* Beds, South Dakota.

TYPE.—Left p_4-m_3 , A.M.1347a. This paper, *Fig. 64*.

- (5a and 5b) vars., from Sioux County, Nebraska, and Cedar Creek, Colorado.

EXAMPLES.—Ramal fragments.

- (6) (?) *Leptomeryx speciosus* Lambe (1908), from Saskatchewan, Canada.²

TYPE.—m/, Can. Geol. Surv. Coll.

As observed (page 252) there may be considerable doubt as to the allocation of partial cheek-tooth series from the Middle Tertiary deposits between the Leptomerycini and the Blastomerycini. A noteworthy example occurs in the case of a maxilla with p^2-m^2 (A.M.13824) from the Rosebud. In this specimen (Size Group I) the inner mid-root and cusp of the p^3 and p^4 are as prominently developed as in *Parablastomeryx gregorii* or *Pseudoblastomeryx falkenbachii*. Should the specimen be of the Blastomerycini, it may belong to *Problastomeryx primus* of the same beds (page 253); (if of the Leptomerycini, it would seem to represent a species lying near to *L. transmontanus* Douglass of the pre-Rosebud of Montana). A Blastomerycine is also questionably suggested in a fragment from Agate, Nebraska.³

¹ William D. Matthew (1899) notes the occurrence of this species in North Dakota and Canada. Harold J. Cook (1934, *Amer. Mid. Nat.*, XV, No. 2, pp. 153, 154) describes and figures under three additional species, *L. antecedens*, *L. exilis* and *L. lenis*, fragmentary specimens from the Chadron and Brule of Nebraska. Erich M. Schlaikjer (1935, *Bull. Mus. Comp. Zool.*, LXXVI, No. 4, p. 182) refers to *L. evansi* a fragmentary skull and jaws from the Chadron, Goshen County, Wyoming.

² Questioned species (6a) and (6b), page 631, include *L. esulcatus* Cope and *L. semicinctus* Cope (1889), based on remains from Saskatchewan, challenged by Matthew (1902).

³ Harold J. Cook (1934, loc. cit., p. 155) describes and figures a small species, *L. agatensis*, from the Lower Harrison of Agate, Nebraska, based on a maxilla with p^1-m^2 .

Detailed Lists of Types, Referred Specimens, and Synonymy

Leptomeryx, total available specimens, 400; total listed, 52; unlisted, 348.

Heteromeryx, total available listed specimens, 1.

SIZE GROUP I.

(1) *Leptomeryx obliquidens* Lull

From the *Protoceras* Beds, South Dakota

Leptomeryx obliquidens LULL, 1922, Amer. Journ. Sci. (5), IV, p. 115. MATTHEW, 1926, Amer. Mus. Novitates, No. 215, p. 4.

TYPE.—Posterior portion of Y.P.M.10541
skull and jaws with cheek
teeth.

According to Lull (1922), size large, being one-fourth larger, and bullæ less inflated than *L. evansi* of the *Oreodon* beds; "superior molars obliquely set"; and $p^2-m^3 = 48$ mm. versus 39 mm. in *L. evansi*.

TENTATIVELY REFERRED FROM THE TYPE AREA OF SOUTH DAKOTA.—

Left ramus with p_1-m_3 and A.M.1332 This paper, *Figs. 65, 67.*
 p_2 alveolus.

The specimen exhibits short diastema, p_2 (alveolus) and p_3 . p_2 (alv.)- $m_3 =$ (49) mm.

While the length of the three /ps approximates, the three /ms are far shorter than in *Parablastomeryx gregorii*. Similarly, while the /ps are longer, the /ms are shorter than in *Problastomeryx primus*.

(2) *Leptomeryx transmontanus* Douglass

From the Oligocene, Montana

Leptomeryx transmontanus DOUGLASS, 1903, Ann. Carn. Mus., II, No. 2, pp. 151, 167, Fig. 11.

Leptomeryx ? esulcatus COPE, MATTHEW, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 222, Fig. 15.

Leptomeryx drummondianus DOUGLASS, MATTHEW, 1926, Amer. Mus. Novitates, No. 215, p. 4.

TYPE.—Partial skull. C.M.726 From east of Drummond on
m³ width = 8 mm. Hellgate River.
Figured by Douglass, 1903,
Fig. 11.

(2a) (?)Var.

From the Pipestone Beds, Montana

Ramal fragments from the Pipestone Beds of Montana, as compared to South Dakota A.M.1332 (Fig. 65), exhibit, in addition to larger size, a shorter p_1-p_2 diastema and anteroposteriorly longer and more compressed p_r-p_s . The p_1 is similarly detached and small peg-like. The p_r-m_2 length is estimated at 50+ mm. Exemplified by the remains in the American Museum collection referred by Matthew (1903) to *L. mammifer* Cope. It is possible that these Pipestone remains represent no more than larger individuals of the same species as the smaller remains listed below under (4c). According to Douglass' figure, the type specimen is of intermediate size.

Leptomeryx mammifer COPE, referred MATTHEW, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 224, Figs. 16 and 17.

EXAMPLE.—Left ramus with p_1-p_2 , and doubtfully asso- ciated m_1-m_2 . (M++) $m_2 = 9.5$ mm.	A.M.9684	Figured by Matthew, 1903, Fig. 16 (in part), under <i>L.</i> <i>mammifer</i> Cope, ref.
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REFERRED, IN AMERICAN MUSEUM COLLECTION.—

Left ramal fragment with p_r-p_4 and p_2 alveolus.	A.M.9686	Figured by Matthew, 1903, Fig. 16 (in part).
Left fragment with p_r-p_1 .	A.M.9687	Figured by Matthew, 1903, Fig. 17.
Right fragment with p_r- m_1 .	A.M.9689	Figured by Matthew, 1903, Fig. 17 (p_4).
Right fragment with m_1- m_2 (br.).	A.M.9688	
Upper molar. 9×10 mm.	A.M.9705	

(3) *Leptomeryx mammifer* Cope (1885)

From Saskatchewan, Canada

Leptomeryx mammifer COPE, 1885 (1886), Rept. Geol. and Nat. Hist. Surv. Canada, I, Appendix to Art. C, p. 84c; 1891, Geol. Surv. Canada, Contrib. Canadian Pal., III, p. 22, Pl. xiv, Figs. 6, 7. MATTHEW, 1902, Bull. Amer. Mus. Nat. Hist., XVI, p. 313.

TYPE.—Fragment of ramus with m_r-m_2 . $m_2 = 9.8$ mm. anteroposteriorly.	Can. Geol. Surv. Coll.	From <i>Titanotherium</i> Beds, Swift Current Creek. Figured by Cope, 1891, Pl. xiv, Fig. 7.
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REFERRED.—

Upper molar.

Can. Geol.
Surv. Coll.Figured by Cope, 1891, Pl.
xiv, Fig. 6.

SIZE GROUP II.

(4) *Leptomeryx evansi* Leidy (1853), genotypic species

From South Dakota

Leptomeryx evansi LEIDY, 1853, Proc. Acad. Nat. Sci. Phila., VI, p. 394; 1869, Journ. Acad. Nat. Sci. Phila. (2), VII, pp. 165, 383, Pl. xiv, Figs. 1-8.

Trimerodus cedrensis COPE, 1873, Pal. Bull., No. 16, p. 8.

Leptomeryx evansii LEIDY, COPE, 1874, 7th Ann. Rept. U. S. Geol.-Geog. Surv. Terr. for 1873 (Hayden), pp. 464, 503.

Leptomeryx evansi LEIDY, COPE, 1884, Proc. Amer. Phil. Soc., XXII, p. 23. SCOTT, 1891, Journ. Morph., V, No. 3, p. 342, Text-Figs. D-I; 1899, Trans. Wagner Free Inst. Sci. Phila., VI, Pl. I, Fig. 1. MATTHEW, 1902, Bull. Amer. Mus. Nat. Hist., XVI, p. 313; 1908, *ibid.*, XXIV, pp. 544, 548, 552, Text-Figs. 8, 9 and (in part) 10-13. 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, p. 43.

GENOTYPE.—Partial skull and
jaw fragment.

m_2 = (6.9) mm. (according to figure).

N.M.157

From the Mauvaises Terres
of White River, Dakota.

Figured by Leidy, 1869, Pl.
xiv, Figs. 1-6.

REFERRED BY LEIDY (1869).—

Portions of several skulls,
many fragments of jaws
with teeth, and portions of
skeleton.

Collected by Hayden, partly
from the Mauvaises Terres
of White River, Dakota,
and partly from Bear
Creek (a tributary of the
Cheyenne River).

REFERRED, FIVE OF MANY SPECIMENS IN THE AMERICAN MUSEUM, ALL FROM THE CHEYENNE RIVER, SOUTH DAKOTA.—

The remains from the general area in the American Museum include examples of slightly larger [p_2 - m_3 (M), A.M.1345] and smaller individuals [m_1 - m_3 (M+), A.M. 1347, referred to *L. minimus*]. Several Carnegie Museum rami are larger than the type of the latter, A.M.1347A.

Left ramus, p_2 - m_3 . (M)

A.M.1345

1894.

Locked skull (premaxilla
missing) and jaws with
dentition. (w)

A.M.11870

From Lower *Oreodon* Beds,
Big Badlands, 1903.

B.L. = (100) mm.

p_2 - m_3 = 39.6

m_3 = ((9.2+))

Figured by Scott, 1899, Pl. I,
Fig. 1; by Matthew, 1908,
Text-Figs. 8, 10, 11; this
paper, Fig. 65.

Partial skull and jaws. B.L. = say 102 mm.	A.M.1343	From Lower <i>Oreodon</i> Beds, 1894. This paper, <i>Fig. 2A</i> .
Partial skull and mandible with /Is-m ₃ .	A.M.686	From <i>Oreodon</i> Beds, 1892.
Partial skull and jaws. Et cetera specimens in the American Museum.	A.M.688	From <i>Oreodon</i> Beds, 1892.

REFERRED SPECIMEN IN THE CARNEGIE MUSEUM, FROM HARDING COUNTY, SOUTH DAKOTA.—

Right fragment with p ₄ al- veolus and m ₁ -m ₃ .	C.M.11734	1928.
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The Field Museum of Chicago, as recorded by E. S. Riggs (1913, pp. 308, 393 and Pl. LXVIII), has on exhibition a splendid 4 × 7-foot slab from South Dakota containing some twenty-six individuals, of which nine are said to be articulated.

(4a) *Leptomeryx evansi*, or Var.

From Sioux County, Nebraska

EXAMPLE.—Right ramus with I ₁ (br.), roots of I ₂ -C, p ₁ alveolus (br.) and p ₂ -m ₃ . (Largest of the C.M. specimens.)	C.M.3679	From <i>Oreodon</i> Beds, Badland Creek.
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REFERRED, CARNEGIE MUSEUM SPECIMENS FROM THE SAME AREA.—

Right and left rami with broken I ₁ -C, p ₁ -m ₃ .	C.M.3672
Right ramus with p ₁ -p ₂ alveoli and p ₃ -m ₃ .	C.M.455
Left ramus with I ₁ (br.), roots of I ₂ -C, p ₁ -m ₃ .	C.M.512

One specimen from the *Titanotherium* Beds, Sand Creek:

Slightly immature, crushed portions of skull and jaws with partial dentition; an- terior portion of skeleton. Third metacarpal = 49 mm.	C.M.997
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(4b) *Leptomeryx evansi*, or Var.

From White River Formation, Cedar Creek, Logan County, Colorado

EXAMPLE.—Left fragments A.M.6781 In the Cope Collection, 1873.
with dp^3 - dp^4 , and dp^5 -
 dp^6 , and right dp^2 .

(Type of *Trimerodus cedrensis* Cope, 1873.)

REFERRED, IN THE COPE COLLECTION.—

Fore and hind limb specimens: A.M.6782 From Horsetail Creek, Logan County, 1879.

Radius = 74 mm.

Third metacarpal = 40

Third metatarsal = 68

Figured by Scott, 1891, Figs. D-H; by Matthew, 1908, Figs. 9, 12-13 (in part); this paper, *Fig. 25B* (pes and partial manus).

Fragments of skeleton. A.M.6783

Numerous fragmental upper and lower jaws, and a few skeletal elements.

In the American Museum Collection.

(4c) Var.

From Pipestone, Montana

REFERRED [specimens placed with *Leptomeryx ? esulcatus* Cope by Matthew (1903)], FROM WHITE RIVER, TITANOTHERIUM BEDS, PIPESTONE SPRINGS, MONTANA, 1902.—

Parts of lower jaws. A.M.9696, 9706, 9702 Figured by Matthew, 1903, Fig. 15, under *L. esulcatus*, referred.

One right and two left m_1 - m_3 . A.M.9692, 9693 and 9695

Fragments of lower jaws. A.M.9694, 9697-9699, and 9707.

Detached upper teeth.
 $m^3 = 8 \times 8.5$ mm.

REFERRED FRAGMENTS FROM PIPESTONE, MONTANA, IN THE CARNEGIE MUSEUM.—

(Teeth definitely taller-crowned, a trifle larger than in *L. minimus*.)

Right fragment, p_1 - p_2 . C.M.809

Left fragment with /Is C.M.809
and p₁.
Right m₁-m₃(br.). C.M.809

SIZE GROUP III.

(5) *Leptomeryx minimus*, new species

From the *Protoceras* Beds, South Dakota

TYPE.—Left p₄-m₃. (M) A.M.1347a This paper, *Fig. 64*.
m₃ = 8.2 mm. p₄ long anteroposteriorly, molars tending tall-crowned.

QUESTIONABLY REFERRED.—

Left fragment with m₁-m₃. A.M.1347 From *Protoceras* Beds, 1894.
(M+)

Certain indefinite remains from South Dakota, referred by W. D. Matthew to *L. semicinctus* Cope, might be tentatively referred here.

(5a) *Leptomeryx* Var.

From Squaw Creek, Sioux County, Nebraska

EXAMPLE.—Right ramus with Col.M.657
p₂-m₃. (M+)

REFERRED.—

Etc. ramal fragments.

(5b) *Leptomeryx* Var.

From Cedar Creek, Logan County, Colorado

EXAMPLE.—Left fragment with Col.M.340
p₁-m₃. (W+)

(6) (?) *Leptomeryx speciosus* Lambe

From Saskatchewan, Canada¹

Leptomeryx speciosus LAMBE, 1908, Contrib. Canadian Pal., III, Pt. IV, pp. 10, 31,
Pl. VIII, Figs. 10-15.

¹ See footnote, next page.

TYPE.—Upper molar.	Can. Geol.	From Bone Coulee, Cypress
7.8 × 10.2 mm.	Surv. Coll.	Hills, 1904.
		Figured by Lambe, 1908, Pl.
		viii, Figs. 10, 11.

QUESTIONED FROM BONE COULÉE, CYPRESS HILLS, 1904, IN THE CAN. GEOL. SURV. COLLECTION.—

Lower molar.	Figured by Lambe, 1908, Pl.
8 × 5.3 mm.	viii, Figs. 12, 13.
ms, 10.5 mm.	Figured by Lambe, 1908, Pl.
	viii, Figs. 14, 15.
Etc. teeth:	

¹ As observed in a foregoing footnote (page 624, footnote 2), the reference of the following Cope Saskatchewan species has been challenged by William D. Matthew. Their determination is left to the future.

(6a) *Leptomeryx esulcatus* Cope

From Saskatchewan, Canada

Leptomeryx esulcatus COPE, 1889, Amer. Nat., XXIII, No. 267, p. 154; 1891, Geol. Surv. Canada, Contrib. Canadian Pal., III, p. 22, Pl. xiv, Fig. 5.

"*Leptomeryx*" *esulcatus* COPE, MATTHEW, 1902, Bull. Amer. Mus. Nat. Hist., XVI, p. 314.

TYPE.—A single superior molar.	Can. Geol. Surv. Coll.	From White River, <i>Titanotherium</i> Beds, Swift Current Creek.
6.5 × 7.5 mm.		Figured by Cope, 1891, Pl. xiv, Fig. 5.

(6b) *Leptomeryx semicinctus* Cope

From Saskatchewan, Canada

Leptomeryx semicinctus COPE, 1889, Amer. Nat., XXIII, No. 267, p. 154; 1891, Geol. Surv. Canada, Contrib. Canadian Pal., III, p. 23, Pl. xiv, Fig. 8.

"*Leptomeryx*" *semicinctus* COPE, MATTHEW, 1902, Bull. Amer. Mus. Nat. Hist., XVI, p. 314.

TYPE.—Upper molar.	Can. Geol. Surv. Coll.	From White River, <i>Titanotherium</i> Beds, Swift Current Creek.
14 × 15 mm.		Figured by Cope, 1891, Pl. xiv, Fig. 8.

William D. Matthew (1902) observes, "This is clearly not *Leptomeryx*, and is distinct from any described White River genus (except possibly *Calops*, with which I am unable to compare it...)"

REFERRED BY MATTHEW (1902), IN AMERICAN MUSEUM COLLECTION.—

Two upper molars.	From the <i>Protoceras</i> Beds,
(Whereabouts unknown.)	South Dakota.

[An interesting maxillary specimen from the Rosebud, which was considered by Matthew as of *Leptomeryx obliquidens*, well may be of the *Blastomerycini* (see page 624).¹

Leptomeryx sp. MATTHEW, 1908, Bull. Amer. Mus. Nat. Hist., XXIV, p. 548, Fig. 11 (in part).

Leptomeryx obliquidens LULL, referred MATTHEW, 1926, Amer. Mus. Novitates, No. 215, p. 4.

EXAMPLE.—Maxilla with p ² - m ² (br.). (w) ms/ are larger than /ms of A.M.1332. pms/ are not unsuggestive of both the considerably larger <i>Parablastomeryx</i> and the still larger <i>Heteromeryx</i> .	A.M.13824	Lower Rosebud Beds, from near No Flesh Creek, Pine Ridge Indian Reservation, South Dakota, 1907. Figured by Matthew, 1908, Fig. 11 (in part).]
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II. HETEROMERYX MATTHEW

From the *Titanotherium* Beds, South Dakota

The relationships of the genus *Heteromeryx*, still only represented in the fragmentary genotype described by William D. Matthew, are very doubtful. The latter (1905) considered *H. dispar* to be "... partly intermediate between *Leptomeryx* and *Protoceras*, retaining several primitive characters of both... Except for the coössified ulna and radius we might regard *Heteromeryx* as a possible ancestor of *Protoceras*; it comes from a much older horizon... The premolars recall those of *Leptomeryx*, but the molars resemble more nearly those of *Protoceras* except in the form and position of the heavy internal cingula..." The genus, on the character of the unreduced nasals, preferably is referred to the *Leptomerycinae*.

(1) *Heteromeryx dispar* Matthew, genotypic species

Heteromeryx dispar MATTHEW, 1905, Bull. Amer. Mus. Nat. Hist., XXI, p. 23, Text-Figs. 4, 5 and 6.

GENOTYPE.—Crushed and fragmentary skull, includ- ing p ¹ -m ³ ; portions of fore and hind feet.	A.M.12326	Figured by Matthew, 1905, Text-Figs. 4, 5 and 6.
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(Matthew observes size a little larger than *L. mammifer* and somewhat less than *Protoceras*.)

¹ Harold J. Cook (1934, loc. cit., p. 155) bases a species, *L. agatensis*, on a maxilla from the Lower Miocene of Agate, Nebraska.

DIVISION B.—HYPERTRAGULINI

Subfamily 2.—*Hypertragulinæ*

III. *HYPERTRAGULUS* COPE

IIIA. *ALLOMERYX* SINCLAIR

IV. *NANOTRAGULUS* LULL

Figures (in part) 64, 65

The subfamily *Hypertragulinæ* is tentatively interpreted as embracing the genus *Hypertragulus* Cope of the White River and John Day (with which *Allomeryx* is probably synonymous), and the widely differing genus *Nanotragulus* Lull (see page 639) of the Harrison and Rosebud.

III, *HYPERTRAGULUS* COPE (AND IIIA, *ALLOMERYX* SINCLAIR)

The Oligocene *Hypertragulus* is so far known in four species—a small species and its variations from the Colorado-South Dakota-Nebraska area, a species of similar size from the John Day, and smaller species from the John Day and South Dakota-Nebraska area. The Lower Miocene remains from Montana and the Rosebud of South Dakota, previously referred to the genus, are more properly transferred to *Nanotragulus*. The anterior premolars of *Hypertragulus* are reduced and sharp-cusped, and the molar crowns less low, versus *Leptomeryx*. The premolars of *Nanotragulus* are relatively somewhat smaller, the p_2 - p_3 diastema less, the tooth crowns taller and the bullæ more swollen than in *Hypertragulus* proper. The John Day *Hypertragulus hesperius* Hay and diminutive (?) *Hypertragulus minutus* Lull exhibit a height of tooth crown which approximates that of *Nanotragulus*. The condition of the tooth crowns and bullæ in *Nanotragulus* seems almost as suggestive of *Hypisodus* as of *Hypertragulus*. The premolars of the latter are much reduced and the anterior jaw somewhat abbreviated as compared to *Leptomeryx*. The $/C$ is incisiform, the p^1 double-rooted and detached, the p_2 sharp, unicuspid and moderately detached, and the p_3^3 - p_4^4 short and compressed. According to Cope (1879), the ulna and radius, like the cuboid and the navicular and the third and fourth metapodials, are coössified in *H. calcaratus*. The John Day, Oregon, *H. hesperius*, while differing in the relative shortness of the diastemata and in the larger premolars, approaches closely in height of crowns to the Lower Miocene *Nanotragulus*.

Summary of Named *Hypertragulus* Species

Five species and a number of variations are tentatively recognized (the same, while showing certain dimensional variations, fall within Size Groups III and IV of the *Leptomeryx-Hypertragulus* section):

SIZE GROUP III.

- (1) *Hypertragulus calcaratus* Cope, genotypic species, from the Upper Oligocene, Logan County, Colorado.

GENOTYPE.—Left maxilla, A.M.6815.

- (1a and 1b) *H. calcaratus* vars., from the Lower *Oreodon* Beds of South Dakota, and from Bridgeport, Nebraska.¹

EXAMPLES.—Partial skull and rami, A.M.1341 [this paper, *Fig. 64* (ramus)]; and left maxilla, N.S.M.8-29-6-34.

- (2) *Hypertragulus hesperius* Hay, from the John Day, Oregon.

TYPE.—Locked skull and mandible, A.M.7918. This paper, *Fig. 64*.

- (2a) *H. (Allomeryx) planiceps* (Sinclair), from the John Day, Oregon.

TYPE.—Cranium, U.C.104.

- (2b) *Hypertragulus* species Sinclair, from the *Promerycochaerus* Beds, John Day, Grant County, Oregon.

EXAMPLE.—Right ramus, U.C.1343.

SIZE GROUP IV.

- (3) (?) *Hypertragulus minor*, n.sp., from Bridgeport, Nebraska.

TYPE.—Left m_1 – m_3 (erupting) and germ of $?p_4$, N.S.M.9-3-7-34.

- (4) (?) *Hypertragulus minutus* Lull, from the John Day, Oregon.

TYPE.—Fragments of jaws and teeth, Y.P.M.10545.

- (5) (?) *Hypertragulus dakotensis*, n.sp., from Big Badlands, South Dakota.

TYPE.—Right p_4 – m_2 , A.M.689a.

¹ Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 151, describes and figures four variable-sized species of *Hypertragulus*, based on fragments from the Oligocene of Nebraska. Chester Stock, 1935, Carn. Inst. Wash. Pub. 453, p. 123, describes *Hypertragulus fontanus* from the Sespe of California.

Detailed Lists of Types, Referred Specimens, and Synonymy

Hypertragulus (and *Allomeryx*), total available specimens, 311; total listed, 29; unlisted, 282.

SIZE GROUP III.

(1) *Hypertragulus calcaratus* Cope, genotypic species

From Logan County, Colorado

Leptauchenia calcarata COPE, 1873, Pal. Bull., No. 16, p. 7.

Hypertragulus calcaratus COPE and *H. tricosatus* COPE, 1874, 7th Ann. Rept. U. S. Geol.-Geog. Surv. Terr. for 1873 (Hayden), pp. 502, 503; Bull. U. S. Geol.-Geog. Surv. Terr., Ser. I, No. 1, pp. 26, 27; (1873), Proc. Acad. Nat. Sci. Phila., XXV, p. 419.

Hypertragulus calcaratus COPE, 1879, Bull. U. S. Geol.-Geog. Surv. Terr., Ser. V, No. 1, p. 66 (largely John Day, Oregon); 1884, Proc. Amer. Phil. Soc., XXII, p. 24 (knows but one species) (W. R. and John Day). LULL, 1922, Amer. Journ. Sci. (5), IV, p. 112.

GENOTYPE.—Left maxilla with p^2-m^3 . (M) A.M.6815 From Cedar Creek, 1873.

REFERRED FROM CEDAR CREEK.—

Right ramus with broken /C and p_1 , etc. alveoli and m_1-m_3 . A.M.6818

Right p_2 root- m_3 . A.M.6819

Right /C alveolus- p_1 and p_2-p_4 . A.M.6822

Smaller-toothed:

Left p_4-m_3 . A.M.6834

(1a) *Hypertragulus calcaratus*, Var.

From the Lower *Oreodon* Beds, Cheyenne River, South Dakota

EXAMPLE.—Anterior one-half skull with C/ and p^1 alveoli, p^2-m^3 ; and rami with /C- p_2 alveoli and p_4-m_3 . A.M.1341 1894.
(M++) This paper, *Fig. 64* (ramus).

REFERRED.—

From *Oreodon* Beds, Cheyenne River, 1892:

Partial skull with small bulla, $p^4(\text{br.})-m^3$; left ramus with p_2 (root) detached, $p_3(\text{root})-m_3(\text{br.})$; and limb fragments. . . .	(M)	A.M. 686a
Left maxilla and ramus with dentition.		686aa

(1b) *Hypertragulus calcaratus*, Var.

From Bridgeport, Morrill County, Nebraska

EXAMPLE.—Left maxilla with N.S.M.8-29-6-34

p^4-m^3 . (M++)

(Slightly larger than *H. calcaratus*.)

REFERRED.—

Left m_1-m_2 .

N.S.M.26-6-6-34

Right m_3 . (M)

Two fragments.

(2) *Hypertragulus hesperius* Hay

From the John Day, Oregon

Hypertragulus calcaratus COPE, 1879, Bull. U. S. Geol.-Geog. Surv. Terr., Ser. V, p. 66 (in part); 1884, Proc. Amer. Phil. Soc., XXII, p. 24 (in part); 1889, Amer. Nat., XXIII, Pl. VI. Referred SCOTT, 1899, Trans. Wagner Free Inst. Sci. Phila., VI, p. 17, Pl. I, Figs. 3, 4.

Hypertragulus hesperius HAY, 1902, Bibliography and Catalogue of Fossil Vertebrata of North America, p. 675. LULL, 1922, Amer. Journ. Sci. (5), IV, p. 113.

As remarked on a previous page, the John Day remains of the Cope Collection referred to this species and to (?) *H. minutus* are somewhat taller-crowned than in the case of the *H. calcaratus* specimens. The series includes specimens which are of larger to considerably smaller dimensions than the type specimen. The larger-sized remains are exemplified by a right ramus with p_1-p_2 roots and p_3-m_3 , A.M.7940, and a right ramus with p_1 root- m_3 (w+), A.M.7932; and the smaller-sized, by a right fragment with /C and p_3 roots, p_1 , $p_2-m_3(\text{br.})$, A.M.7980, and a left fragment with p_2-m_3 , A.M.7969. The two latter specimens, A.M.7980 and 7969, are referred to (?) *H. minutus*.

TYPE.—Locked skull and jaws with I_3 (br.), p_1^1 detached and double-rooted, p_2 detached, and $p_3^2-m_3^3$. (w++)
 $p_2-m_3 = ((30.5+))$ mm.

A.M.7918

Figured by Cope, 1889, Pl. VI; by Scott, 1899, Pl. I, Figs. 3, 4; this paper, Fig. 64.

REFERRED.—

Partial skull with p^3-m^3 .	A.M.7930
Partial skull with p^2-m^3 , and portions of metatarsi.	A.M.7916
Parts of right and left rami with /Is alveoli- m_3 .	A.M.7933
Right ramus with /C root- m_3 (in matrix).	A.M.7979
Three rami.	A.M.7936, 7947 and 7962

Slightly larger than type:

Right ramus with p_1-p_2 roots and p_3-m_3 . (M+)	A.M.7940
Right ramus with p_1 root- m_3 . (W+)	A.M.7932

(2a) *Hypertragulus* (*Allomeryx*) *planiceps* (Sinclair)From *Diceratherium* Beds, John Day, Grant County, Oregon

Allomeryx planiceps SINCLAIR, 1905, Univ. Cal. Pub. Bull. Dept. Geol., IV, p. 129, Pl. XIV, Figs. 1, 2. MERRIAM AND SINCLAIR, 1907, *ibid.*, V, p. 187 and footnote 42. LULL, 1922, Amer. Journ. Sci. (5), IV, p. 114.

TYPE.—Cranium, lacking muzzle, with p^2 root and p^3-m^3 . (W++)	U.C.104	Figured by Sinclair, 1905, Pl. XIV, Figs. 1, 2.
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(According to figure, approximates *Hypertragulus hesperius*.)(2b) *Hypertragulus* species SinclairFrom *Promerycochaerus* Beds, John Day, Grant County, Oregon

Hypertragulus sp. SINCLAIR, 1905, Univ. Cal. Pub. Bull. Dept. Geol., IV, p. 128, Pl. XIV, Fig. 3.

EXAMPLE.—Right ramus with roots of three small /Is and incisiform /C, adjacent caniniform p_1 , diastema, p_2 roots, long diastema, and p_3-m_3 .	U.C.1343	Figured by Sinclair, 1905, Pl. XIV, Fig. 3.
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SIZE GROUP IV.

CHARACTER OF LOWER MOLARS INTERMEDIATE BETWEEN *Hypertragulus* AND *Nanotragulus*, AND PERHAPS TENDING MORE NEARLY TO APPROXIMATE THE LATTER THAN THE FORMER:

(3) (?) *Hypertragulus minor*, new species

From Bridgeport, Morrill County, Nebraska

Size of *H. calcaratus*, but tall crowns

TYPE.—Left m_1-m_3 (erupting) N.S.M. 9-3-7-34
and germ of $?p_4$.

$m_1-m_3 = 19.5$ mm.

Specimen made available for study through the kindness of the University of Nebraska.

(4) (?) *Hypertragulus minutus* Lull

From the Upper Oligocene, John Day, Oregon

Hypertragulus minutus LULL, 1922, Amer. Journ. Sci. (5), IV, p. 115.

TYPE.—“Fragments of upper Y.P.M. 10545
and lower jaws and teeth.”

According to Lull, $m_1-m_3 = 14$ mm., versus 20 mm. in *H. hesperius*.

The writer finds that in the smallest specimen in the American Museum collection from the John Day, the m_1-m_3 measure 19.5 mm.

QUESTIONABLY REFERRED.—

		A.M.
Right fragment with roots of /C and p_2, p_1, p_3-m_3 (br.)	(M+)	7980
Left fragment with p_2 (detached) $-m_3$. ($m_1-m_3 = 19.5$ mm.)	(M)	7969

(5) (?) *Hypertragulus dakotensis*, new species

From *Protoceras* Beds, Big Badlands, South Dakota, 1892

		A.M.
TYPE.—Right p_4-m_2	(W)	689a

REFERRED.—

Right p_2 (root) $-m_3$. ($m_1-m_3 = 18.5$ mm.)	(M+)	689b
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IV. NANOTRAGULUS LULL

The *Nanotragulus* dentition tends to be intermediate in character to the more specialized forms of *Hypertragulus* and *Hypisodus*. The present data, interestingly enough, indicate *Nanotragulus* to be of definitely later occurrence than *Leptomeryx* and the two latter genera, the four recognized species all being derived from the Lower Miocene. The genotypic species is *N. loomisi* Lull. As seen in the alveoli of the type (A.M.13011) of the referred species, *N. ordinatus*, the /C and p_1 were nearly adjacent, the p_1 single-rooted and followed by a rather long diastema, the p_2 sharp, unicuspid, and at most slightly separated from p_3 , the p_3 - p_4 reduced, the /ms tall with reduced cingular tubercles, and the ramus very slender versus *Hypertragulus*. Loomis (1933) has observed that lateral toes were retained at least in his South Dakota specimens, also that the limbs of *Nanotragulus* were 20% longer than in Recent *Tragulus*. *Nanotragulus* definitely differs from *Hypertragulus* proper in greater reduction of the premolars, abbreviation of the p_2 - p_3 diastema, more hypsodont and cingula-less molars and enlarged auditory bullæ. Since writing the above our laboratory has discovered, embedded in the matrix of a large block of camel remains secured near the type locality of *N. loomisi*, the major portions of three skulls and a number of mandibular rami and skeletal elements of a small *Nanotragulus*-like form (see Fig. 64). The limb bones are of smaller size than those recorded from South Dakota.

Summary of Named Species

(The four named *Nanotragulus* species and referred remains fall within Size Groups I-IV of the *Leptomeryx*-*Hypertragulus* series):

SIZE GROUP I.

- (1) *Nanotragulus albanensis*, n.sp., from the Lower Harrison, Nebraska.¹

TYPE.—Right ramus, A.M.13784. This paper, Fig. 65.

¹ Since the preparation of this manuscript a new species of *Nanotragulus*, *N. matthewi* Cook, has been described from Nebraska, and a species, *N. intermedius* Schlaikjer, from Goshen Hole, Wyoming.

Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 160, Pl. iv, Fig. 11, type, m¹-m³, 21 mm., approximating Size Group III.

Schlaikjer, Erich M., 1935, Bull. Mus. Comp. Zool., LXXVI, No. 4, p. 178, Figs. 12, 13, Pl. XL, and Pl. XLI, Fig. 4, paratype, p²-m³, 25 mm. (according to figure), approximating smaller specimens of Size Group III (and versus 27 mm. given by Lull for his type of *N. loomisi*). The type is an immature individual with dp₄² retained. The reported dimensions, incompleteness of the posterior border of the orbit and relative smallness of the bullæ may be due to adolescence.

SIZE GROUP II.

- (2) *Nanotragulus ordinatus* (Matthew), from the Lower Rosebud, South Dakota.

TYPE.—Left ramus, A.M.13011. This paper, *Fig. 64*.

- (2a) *N. ordinatus*, var., from Keeline, Wyoming.

EXAMPLE.—Right ramus, F.A.M.31534. This paper, *Fig. 64*.

SIZE GROUP IV.

- (3) *Nanotragulus loomisi* Lull, genotypic species, from the “?Monroe Creek,” Wyoming.

GENOTYPE.—Palate and partial mandible, Y.P.M.10330.

- (3a) *Nanotragulus lulli*, n.sp., from the Lower Rosebud, South Dakota.

TYPE.—Fragmental skull and partial rami, A.M.13821. This paper, *Fig. 64*.

Detailed Lists of Types, Referred Specimens, and Synonymy

Nanotragulus, total available specimens, 39 (9 unlisted)

SIZE GROUP I.

- (1) *Nanotragulus albanensis*, new species

From the Lower Harrison, Sioux County, Nebraska, 1907

(Heretofore allocated to *Hypertragulus ordinatus*)

TYPE.—Right ramus with p_1 - m_3 . (w) A.M.13784 This paper, *Fig. 65*.

p_1 - m_3 inclusive = 52.5 mm.

(p_2 not separated from p_3 .)

REFERRED FROM TYPE LOCALITY, SLIGHTLY SMALLER SPECIMEN.—

Left ramus with p_2 - m_3 . (M) A.M.13785

SIZE GROUP II.

(2) *Nanotragulus ordinatus* (Matthew)

From Porcupine Creek, Lower Rosebud, South Dakota, 1906

Hypertragulus ordinatus MATTHEW, 1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 218.

TYPE.—Left ramus with p_2 - m_3 and /C root (p_1 alveolus widely and p_2 slightly detached). (w)
 p_1 - m_3 inclusive = (50.7) mm.

REFERRED.—

Right fragment with diastema, p_2 - p_3 roots and p_4 . (w) A.M.13013

Left m_1 - m_3 . (M+) A.M.13013x

Left dp_4 - m_2 (br.). A.M.13012

(2a) *Nanotragulus ordinatus*, Var.

From Keeline, Wyoming, 1931

EXAMPLE.—Right ramus with p_2 - m_3 , in which p_2 is not separated. (w) F:A.M.31534 This paper, *Fig. 64*.

REFERRED FROM TYPE LOCALITY.—

Right ramus with p_2 - m_3 , in which p_2 is separated. (w+) F:A.M.31535

Five fragmental rami. F:A.M.31536, A-D

SIZE GROUP IV.

(3) *Nanotragulus loomisi* Lull, genotypic species

From Big Muddy River, "Monroe Creek," Wyoming

Nanotragulus loomisi LULL, 1922, Amer. Journ. Sci. (5), IV, p. 116, Fig. 1.

GENOTYPE.—Palate with upper cheek teeth and partial mandible.

Y.P.M.10330

From Castle Butte, near Spanish Mines, Big Muddy River, Wyoming, 1908.

Figured by Lull, 1922, Fig. 1.

According to Lull, p^2 single-cusped, trenchant and detached, p^3 trenchant, p^4 unique, "triangular," lower molars with no accessory pillars, series subhypsodont; specimen representing smallest so far described Lower Miocene Artiodactyl. $p^2-m^2 = 27$ mm.

REFERRED FROM NEAR TYPE LOCALITY.—

Remains of some five or more individuals associated in one sandstone block, collected by Charles Falkenbach in the late fall of 1934. While the dentition measures slightly larger, the limbs are notably shorter than the South Dakota remains as measured by Loomis.

		F.A.M.
Partial skull (lacking muzzle and superior occiput) and mandible with p^2-m^3	(w) <i>Fig. 84</i>	31525
Skull (dorsal area missing) and mandible with p^2-m^3	(w)	31523
Partial skull with p^2-m^3	(M+)	31524
Left ramus with symphysis, m_1-m_2 and alveoli.....	(M+)	31526
Right fragment with p_2-m_2	(W+)	31527
Right fragment with p_2-m_2	(w)	31528
Left fragment with p_2-m_2	(W+)	31529
Left fragment with m_1-m_2	(w)	31529A
Right fragment with partial symphysis, p_2 alveolus, p_2-p_4 , m_1 root and m_2-m_3	(w)	31529B
Left p_2-m_2	(w)	31529C
Two lower molars.....	(w)	31529D
		and E
Right m^1-m^3	(M)	31533
Left m^2-m^3	(M)	31533A

Limb elements (apparently representative of three different individuals, tentatively held under numbers F:A.M.31537-39; see measurements below):

Partial left scapula.

Left humerus.

Left radius and ulna.

Distal right humerus and proximal two-thirds radius and ulna, articulated.

Right and left nearly complete ilia and right femur, articulated.

Partial right ilium.

Left femur (superior trochanter missing and distal condyles crushed).

Right tibia, astragalus and calcaneum, articulated.

Distal four-fifths left tibia and astragalus, articulated.

Distal three-fourths right tibia.

Distal four-fifths left tibia, tarsus and metatarsus, articulated.

Distal end of right tibia and astragalus, articulated.

Right astragalus, partial calcaneum, left cuboid and fragments.

REFERRED FROM WILLOW CREEK, 1935.—

		F.A.M.
Right ramus with posterior portion of symphysis and p_2-m_2 ..	(w)	32850

		F:A.M.
Left fragment with p ₂ -m ₃	(M)	32851
Left fragment with p ₂ -m ₃	(M)	32852

(3a) *Nanotragulus lulli*, new species

From the Lower Rosebud, South Dakota

The bullæ are extremely large versus John Day *Hypertragulus*. The detached limb elements are disproportionately large as compared to the Wyoming species *N. loomisi* (see comparative measurements following). Type slightly larger than *N. loomisi*.

Nanotragulus loomisi LULL, referred MATTHEW, 1926, Amer. Mus. Novitates, No. 215, p. 4, Fig. 3.
Nannotragulus loomisi LULL, LOOMIS, 1933, Amer. Journ. Sci. (5), XXV, p. 390, Figs. 1-6.

TYPE.—Fragmental skull with enlarged bullæ and partial rami, exhibiting p₂-m₃. (M+) A.M.13821 Figured by Matthew, 1926, Fig. 3; this paper, *Fig. 64* (ramus and bulla).

REFERRED.—Four specimens, including skeletal elements cited by Loomis (1933) in the Amherst College collection.

TABLE XVII
HYPERTRAGULINI COMPARATIVE LIMB MEASUREMENTS AND RATIOS

	Locality	Collection No.	Humerus	Radius	3d Metacarpal	Femur	Tibia	3d Metatarsal
			mm.	mm.	mm.	mm.	mm.	mm.
<i>Heteromeryx dispar</i> , genotype (part).....	S. Dak.	A.M.12326 ¹		(117)	70			
<i>Leptomeryx evansi</i> , var. . .	Logan Co., Colo.	A.M.6782 ²	(73)	74	40		122	68
“.....	Sioux Co., Nebr.	C.M.997 ³	76	79	49			
<i>Nanotragulus lulli</i> , ref. . . (after Loomis, 1933)	S. Dak.	Amherst Coll. unassoc.		79		97	118	56
<i>N. loomisi</i> , ref.	Wyo.	F:A.M.31537-9 unassoc.	68	66.5		77	103	50

() approximate measurement.
¹ A.M.12326, 3d metacarpal/radius = (60)%.
² A.M.6782, humerus/radius = (99)%; 3d metacarpal/radius = 54%; radius/tibia = 61%; 3d metatarsal/tibia = 56%; 3d metacarpal/3d metatarsal = 59%.
³ C.M.997, humerus/radius = 96%; 3d metacarpal/radius = 62%.

DIVISION C.—HYPISODONTINI

Subfamily 3.—Hypisodontinæ

V. HYPISODUS COPE

Figure 64 (in part)

Statement

The division is considered to embrace the single subfamily Hypisodontinæ and the peculiar genus *Hypisodus*, genotypic species *H. minimus* Cope, from Colorado, and the referred species from Nebraska.

Newly available data as to this remarkable and so far poorly represented genus include a partial maxillary-mandibular series, a nearly complete mandible, and a partial skull and associated mandible from Sioux County, Nebraska, now in the Carnegie Museum collection. While the partial skull and mandible are of a much smaller creature than the American Museum Colorado partial skull and ramus, the several Nebraska and Colorado specimens may represent no more than different-sized individuals.

William D. Matthew (1902) observed that the genus' "real relationships are more nearly with *Hypertragulus* than anything else, but it is a remarkably modernized animal for the formation in which it is found." Matthew (1910) suggested that *Hypisodus* might have affinity with the *Stenomylinæ*. Zittel (1923) transferred the genus to the *Antilocapridæ*. Additional data as to the character and distribution of *Hypisodus* are much to be desired.

Characters.—The skull apparently was extremely brachycephalic, the occiput narrow, produced posteriorly, the orbits large and enclosed, the lacrimal vacuity small and the bullæ much swollen. The mandible is said to have lacked the camelid hook. The p_1 closely adjoined the /C, and like the latter was incisiform; the post-/C diastema was long; the p_2 was apparently small and single-rooted with a tendency to be detached from p_3 ; the p_3 was reduced, the p_4 elongate, compressed, and the molars notably hypsodont. The metatarsus seems to have been short relative to the basilar length of the skull. Matthew (1901) notes the ulna and radius, like the distal end of the fibula and tibia and the cuboid and navicular, to have been coössified; the median metatarsals to have been distinct and the laterals thread-like.

Summary of Named Species

- (1) *Hypisodus minimus* Cope, genotypic species, from Logan County, Colorado.

GENOTYPE.—Maxillary fragment, A.M.6543.

- (1a) *Hypisodus ringens* Cope, from northeastern Colorado.

TYPE.—In question.

- (2) *Hypisodus alacer* Troxell, from Nebraska.¹

TYPE.—Partial skull and jaws, Y.P.M.10033.

Detailed Lists of Types, Referred Specimens, and Synonymy

Hypisodus, total available listed specimens, 19

- (1) *Hypisodus minimus* Cope, genotypic species

From Colorado

Leptauchenia minima COPE, 1873 (August), Pal. Bull., No. 16, p. 8.

Hypisodus ringens COPE and *Leptauchenia minima* COPE, 1873 (October), Synopsis New Vertebrata from the Tertiary of Colorado, pp. 7 and 14.

Hypisodus minimus COPE, 1874 (January), Bull. U. S. Geol.-Geog. Surv. Terr., Ser. I, No. 1, p. 26; 1874, 7th Ann. Rept. U. S. Geol.-Geog. Surv. Terr. for 1873 (Hayden), p. 501.

Hypisodus minimus COPE, referred MATTHEW, 1901, Mem. Amer. Mus. Nat. Hist., I, pp. 358, 440, Fig. 34; 1902, Bull. Amer. Mus. Nat. Hist., XVI, pp. 311, 316, Fig. 1.

GENOTYPE.—Left fragment A.M.6543
with m¹-m².

Molar series length = 12 mm.

Last molar length = 5

From Cedar Creek, Logan
County, Colorado (White
River Formation).
Cope Collection (Cope's No.
1, 1873).

¹ Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 156, describes and figures two species, *H. paululus* from Crawford, Dawes County, and *H. ironsi* from the Brule at the base of the Gering, Scotts Bluff, based on portions of mandibular dentitions—see figures and measurements.

REFERRED.—

Skull, lacking muzzle, and right ramus.	A.M.9354	From vicinity of Pawnee Buttes, Colorado, 1901. Figured by Matthew, 1902, Fig. 1; this paper, <i>Fig. 64</i> (bulla).
Posterior portion of skull, right maxilla with dp^2-m^3 , right fragment with m_2-m_3 ; distal portion humerus, partial ulno-radius, partial pelvis, proximal portion femur, proximal end tibia, tarsus, partial metatarsus and laterals.	A.M.8989	From Lewis Creek, Logan County, Colorado, 1898. Figured by Matthew, 1901, Fig. 34.

Among the specimens of Cope Collection from Colorado, 1873, are:

Symphysis with all alveoli, left ramus with p_4-m_1 (br.), right ramus with p_2-p_4 roots and m_1 (br.).	[?Perhaps Cope's type of <i>H. ringens</i> .]	A.M. 6563, 6562 and 6561
Left fragment with dp_2-dp_3 alveoli and dp_4-m_3		6551
Right fragment with p_2-p_3 alveoli, p_4-m_2 (br.).....		6554
Right fragment with symphysis, alveoli and dp_3 (?).....		6559
Left fragment with p_4 (erupting)- m_3		6565
Numerous ramal fragments with teeth (unlisted).		

MAXILLÆ

Left fragment with p^4-m^3	6545
Right fragment with m^1-m^3	6546
Left fragment with m^1-m^3	6547
Right fragment with m^3	6550
Upper molar.....	6549

(2) *Hypisodus alacer* Troxell

From Nebraska

Hypisodus alacer TROXELL, 1920, Amer. Journ. Sci. (4), XLIX, p. 393, Figs. 1-3.

TYPE.—Skull and jaws, anterior portions missing.	Y.P.M.10033	Marsh Collection, 1870. Figured by Troxell, 1920, Figs. 1-3.
$p^3-m^3 = 15.7$ mm.	$m_1-m_3 = 11.8$	
$m^1-m^3 = 11$	$m_3 = 5$	
$m^3 = 4$		

REFERRED.—

In the Yale Collection [referred by Troxell (1920, p. 396) to *H. minimus*].—

Maxillary fragment with p^3-m^3 .	Y.P.M.10034	Marsh Collection, 1870. Figured by Troxell, 1920, Fig. 4.
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In the Carnegie Museum Collection, from the *Oreodon* Beds, Sioux County (C.M. 883 and 3684 small relative to Colorado A.M.9354):

Partial mandible with /Is- p_2 alveoli and p_2-m_3 .	C.M.883 (part)	From Badland Creek. Col- lected by O. A. Peterson, 1901. This paper, <i>Fig. 64</i> .
---	-------------------	--

Partial skull with enlarged bullæ, p^3-m^3 ; and broken rami with p_2-m_3 . $m_1-m_3 = 11.5$ mm.	C.M.3684	From Warbonnet Creek. Collected by W. H. Utter- back, 1900.
---	----------	---

Right maxilla with p^3-m^3 ; and two rami with p_2-m_3 .	C.M.3981	From Badland Creek. Col- lected by O. A. Peterson, 1901.
---	----------	--

A considerable number of
fragmentary specimens.

In the Colorado Museum Collection:

Fragment of left ramus with m_1-m_3 .	Col.M.662	From 40 mi. N.W. of Harri- son. Collected by J. D. Figgins, 1917.
--	-----------	---

(An m_3 has been questionably referred from Goshen Hole, Wyoming, by E. M. Schlaikjer, 1935.)

FIG. 66. *Pseudoceras*, n.g., from Nebraska and New Mexico, (?)*Synthetoceras rileyi*, n.sp., and *Prosynthetoceras*, n.subg., ref., from southeastern Texas, Late Tertiary; mandibular dentitions compared.

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. PS, posterior border symphysis.

F:A.M.31997 and 33780, *Pseudoceras klausi*, n.sp., type and ref., rev., from Round Mountain Quarry, New Mexico. (See page 652.)

F:A.M.33722, *Pseudoceras potteri*, n.sp., type, from Cherry County, Nebraska. (See page 652.)

F:A.M.33723, *Pseudoceras skinneri*, n.g. and sp., genotype, from Cherry County, Nebraska. (See page 650.)

F:A.M.34181, (?)*Synthetoceras rileyi*, n.sp., type, rev., from southeastern Texas. (See page 605.)

F:A.M.34180, *Prosynthetoceras francisi*, n.subg. and sp., ref., rev., from southeastern Texas. (See page 605.)

[VI—APPENDIX].—**CAMELIDÆ** (IN PART)

DIVISIONS A.—PSEUDOCERATINI; AND B.—STENOMYLINI

Figures 68 and (in part) 23, 65, 66, 67

Preliminary descriptions are appended of two hitherto unknown Late Tertiary groups, the first consisting of small pseudocameline-like forms of uncertain relationship, and the second confined to a single peculiar, unexpected and highly specialized stenomyline species. The two groups are presented briefly below under the divisions Pseudoceratini and Stenomylini, referred to the Camelidæ.

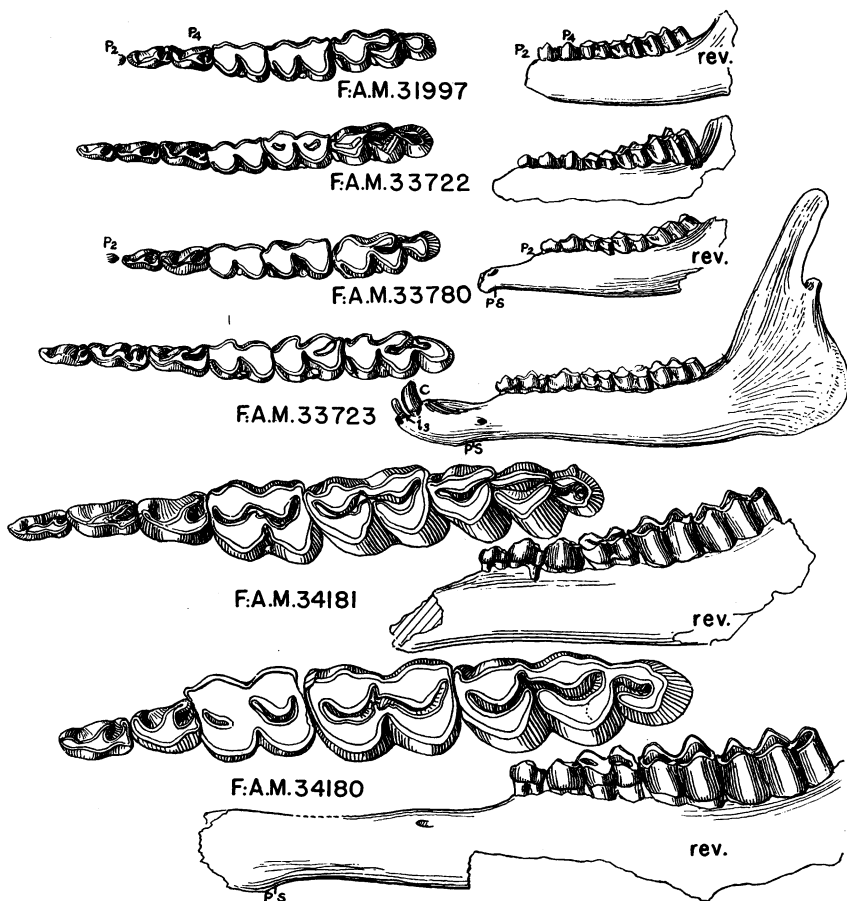


FIG. 66. *Pseudoceras*, n.g., from Nebraska and New Mexico, (?)*Synthetoceras rileyi*, n.sp. (F.A.M.34181) and *Prosynthetoceras*, n.subg., ref. (F.A.M.34180), from southeastern Texas, Late Tertiary; mandibular dentitions compared.

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. (See legend, page 647.)

DIVISION A.—PSEUDOCERATINI

Subfamily 1.—*Pseudoceratinae*

I. *PSEUDOCERAS*, NEW GENUS

Figures 66 and (in part) 23, 65

Statement

A group of diminutive species of doubtful Poebrothere-like character is considered tentatively as representative of a distinct division, *Pseudoceratini*, of the *Camelidae*.

The genotypic species, *P. skinneri*, is based on a small mandibular ramus of unusual appearance, collected in Cherry County, Nebraska, by Morris F. Skinner. The specimen is characterized by extremely short postsymphysis, simplified premolars and moderate-crowned molars provided with buttresses and tubercles. The I_1 is large and procumbent as compared to the smaller and erect I_2 – I_3 , and the $/C$ large and recurved, the condition in $/I$ s and $/C$ tending to parallel that in the Recent *Tragulidae*. A variation of the same form may be represented by a fragmentary specimen from the vicinity of Snake River, collected by the F. W. Johnson party of the University of Nebraska. A slighter species is based on mandibular remains from Brown County and a third and distinctly smaller species is recognized in remains from Cherry County. An equally small and possibly related species, with premolars of more reduced proportions and fully as short postsymphysial length, is described from Round Mountain Quarry, New Mexico. The shortness of the diastema of the genotype recalls both *Paratoceras* and *Protoceras*; however, the premolars are smaller-proportioned than in the much larger *Paratoceras*, and larger-proportioned than in *Synthetoceras*. A possibly distantly allied form is seen in remains from the Pipestone of Montana, which were questionably referred by Matthew to *Eotylopus* as a species, *E. profectus*. In this latter the diastema is even shorter, the premolars larger-proportioned and the molars notably lower-crowned than in any of the foregoing forms from the Late Tertiary. As in *E. profectus* the p_4 lacks the metaconid and the two strong subparallel crests running from the protocone to the heel enclose a narrow lenticular fossa. The genotypic and several referred species and variant are, with reservation, allocated, pending a better understanding of their characters, to the *Camelidae* (rather than to the *Protoceratidae*). Examples are illustrated in Figure 66.

Summary of Named Species

- (1) *Pseudoceras skinneri*, n.g. and sp., from Cherry County, Nebraska.

GENOTYPE.—Left ramus, F:A.M.33723. This paper, *Fig. 66*.

- (2) *Pseudoceras wilsoni*, n.sp., from Brown County, Nebraska.

TYPE.—Partial right ramus, F:A.M.31561. This paper, *Fig. 23*.

- (2a) Var., from Cherry County, Nebraska.

EXAMPLE.—Left fragment of ramus, N.S.M.1-11-7-35.

- (3) *Pseudoceras potteri*, n.sp., from Cherry County, Nebraska.

TYPE.—Left ramus, F:A.M.33722. This paper, *Fig. 66*.

- (4) *Pseudoceras klausii*, n.sp., from Round Mountain Quarry, New Mexico.

TYPE.—Right ramus, F:A.M.31997. This paper, *Fig. 66*.

For comparison:

- [(5) (?) *Eotylopus profectus* Matthew, from the Pipestone Beds, Montana.

TYPE.—Mandibular fragment, A.M.9681.]

Detailed Lists of Types, Referred Specimens, and Synonymy

Pseudoceras, total available specimens, 28; total listed, 23; unlisted, 5.

- (1) *Pseudoceras skinneri*, new genus and species

From Cherry County, Nebraska

Collected in 1936 by Morris F. Skinner

GENOTYPE.—Left ramus with F:A.M.33723 From E. Kat Quarry.
I₁, /C, p₂-m₃. (M+) This paper, *Fig. 66*.

[I₁ alveolus large, I₂-I₃ small; /C large, recurved; diastema short, postsymphysial distance very short; angle of jaw round and protruding; premolars camelid-formed. Length /ps = 22 mm., or 2½ times postsymphysial distance (8.5 mm.).]

REFERRED.—

- | | | |
|---|-------------|--------------------------------------|
| Left mandibular ramus
with p_2-m_3 . (w+) | F:A.M.33721 | From <i>Machærodus</i> Quarry. |
| (Specimen preserves the posterior border of symphysis; postsymphysial distance as short as in the above specimen; size approximating, but p_3 heavier than in F:A.M.31561.) | | |
| Left fragment with diastema and p_3 (br.)- m_2 .
(M++) | F:A.M.33724 | From E. Kat Quarry Channel, 1936. |
| Left fragment with m_1-m_3 .
(A) | F:A.M.33725 | From W. L. Kat Quarry Channel, 1936. |

REFERRED FROM EAST CHERRY COUNTY.—

- | | | |
|------------------------------------|-------------|-------------------------|
| Left fragment with m_3 .
(M+) | F:A.M.31377 | From Xmas Quarry, 1932. |
| Left fragment with dp_2-m_3 . | F:A.M.31379 | From Kat Quarry, 1931. |

QUESTIONABLY REFERRED.—

- | | | |
|--|-------------|---------------------------|
| Skull with p^2-m^3 , muzzle missing. (w++) | F:A.M.33720 | From Hans Johnson Quarry. |
| [Size of dentition approximating mandibular specimen (33721); orbits placed noticeably forward; bullæ small, inflated; occiput narrow, triangular. Form of much worn p^2-p^3 not unsuggestive of <i>Parablastomeryx</i> .] | | |

(2) *Pseudoceras wilsoni*, new species

From Brown County, Nebraska

[Extremely short diastema and large, compressed /ps. Length of /ps (19 mm.) twice postsymphysial distance (9.5 mm.); crowns moderate.

- | | | |
|--|-------------|--|
| TYPE.—Right ramus with diastema, p_2-m_1 and m_3 .
(M+) | F:A.M.31561 | From J. Wilson Ranch,
Brown County, 1933.
This paper, <i>Fig. 23</i> . |
|--|-------------|--|

REFERRED¹ FROM TYPE LOCALITY.—

- | | | |
|-------------------------------------|-------------|-------|
| Right fragment with m_1-m_2 . (A) | F:A.M.31384 | 1934. |
|-------------------------------------|-------------|-------|

¹ Left ramus with posterior symphysis and p_2-m_3 (M++), F:A.M.34000. (Not otherwise listed.)

(2a) Var.

From Snake River, Equivalent of Xmas Quarry Zone, Cherry County, Nebraska

EXAMPLE.—Left fragment with N.S.M.1-11-7-35 Collected by F. W. Johnson
posterior symphysis and party, 1935.
 p_2-m_1 (br.). (w+)

(3) *Pseudoceras potteri*, new species

From Cherry County, Nebraska

TYPE.—Left mandibular ra- F:A.M.33722 From Hans Johnson Quarry.
mus with p_2-m_3 . (M) This paper, Fig. 66.

[p_2-m_3 measuring 45.5 mm., as in *P. klausi*, versus *P. skinneri*, type (F:A.M. 33723), 53 mm.]

(4) *Pseudoceras klausi*, new species

From Round Mountain Quarry, New Mexico

TYPE.—Right ramus with p_2 F:A.M.31997 This paper, Fig. 66.
root- m_3 . (M+)
(Proximity of posterior symphysis indicated.)

REFERRED.—

		F:A.M.
Right ramus with postsymphysis, p_2 alveolus and p_3-m_3	(w)	33780
	Fig. 66	
Right ramus with postsymphysis and p_2-m_3	(w+)	33781
Right ramus with p_3-m_3 (m_1 br.).....	(M++)	33782
Left ramus with p_2 (br.)- m_3	(w)	31983
Right fragment with p_2 root- m_3 . (/ps slighter.).....	(w+)	31984
Left fragment with p_4-m_3	(M++)	33783
Left fragment with p_4-m_3	(w)	33784
Left p_3 root- m_1	(M+)	31984A
Right m_1-m_3	(w+)	31984B
Five fragments.		

QUESTIONABLY REFERRED.—

Left maxilla with p^2-m^2	(M+)	31985
Right p^4-m^2	(M)	31985A

(5) (?) *Eotylopus profectus* Matthew

From the Pipestone Beds, Montana

[For comparison]

Leptotragulus profectus Matthew, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 224, Text-Fig. 18.

(?) *Eotylopus profectus* Matthew, *ibid.*, XXVIII, p. 40.

TYPE.—Mandibular fragment with /Calveolus, short dia- stema and p_2-m_1 .	A.M.9681	Figured by Matthew, 1903, Text-Fig. 18.
---	----------	--

REFERRED BY MATTHEW.—

Fragments.	A.M.9682 9683
------------	------------------

REFERRED BY WRITER.—

Right ramus with p_3-m_3 (br.) and p_1-p_2 alveoli. $p_3-m_3 = 34.5$ mm. Diastema very short and /ps relatively large.	C.M.809b	This paper, Fig. 65.
---	----------	----------------------

Right fragment with p_2 , etc.	C.M.809a
-------------------------------------	----------

Tooth crowns lower, premolars less compressed and diastema shorter than in *Protomeryx campester* Matthew (1901) or *Poebrotherium* Cope (1881). As noted by Matthew (1903) in *Eotylopus* (*Leptotragulus*) *profectus* the p_4 "... has no deuterocone, but two strong posterior crests from protocone to heel sub-parallel, enclosing a narrow lenticular fossa. The third premolar is similar, but more compressed..." Matthew observes *L. profectus* as being one-fifth larger than *L. proavus* Scott of the Uinta and that "... It is throughout very suggestive of *Poebrotherium*, much more so than either *Protylopus* or *Leptotragulus proavus*, in the details and conformation of the molar and premolar cusps..." Matthew (1910) "... It is probable that the jaw fragments and teeth which I referred in 1903 to *Leptotragulus* (*L. profectus* Matthew) from the Lower Oligocene of Montana, belong to this genus, although they do not agree well enough for specific identity... *Eotylopus* is very much closer to *Protylopus* than to *Poebrotherium* and might much more readily be derived from it..." Matthew refers *Eotylopus* to the Leptotragulinae with affinities to the Camelidæ. (The genotype *Eotylopus reedi* from the Lower Oligocene of Wyoming lacks diastemata in both jaws; the metacarpals are short detached with lateral digits complete, although slender, and distal keels confined to the palmar surface; and the lateral digits of the pes are reduced to nodules as in *Poebrotherium*.)

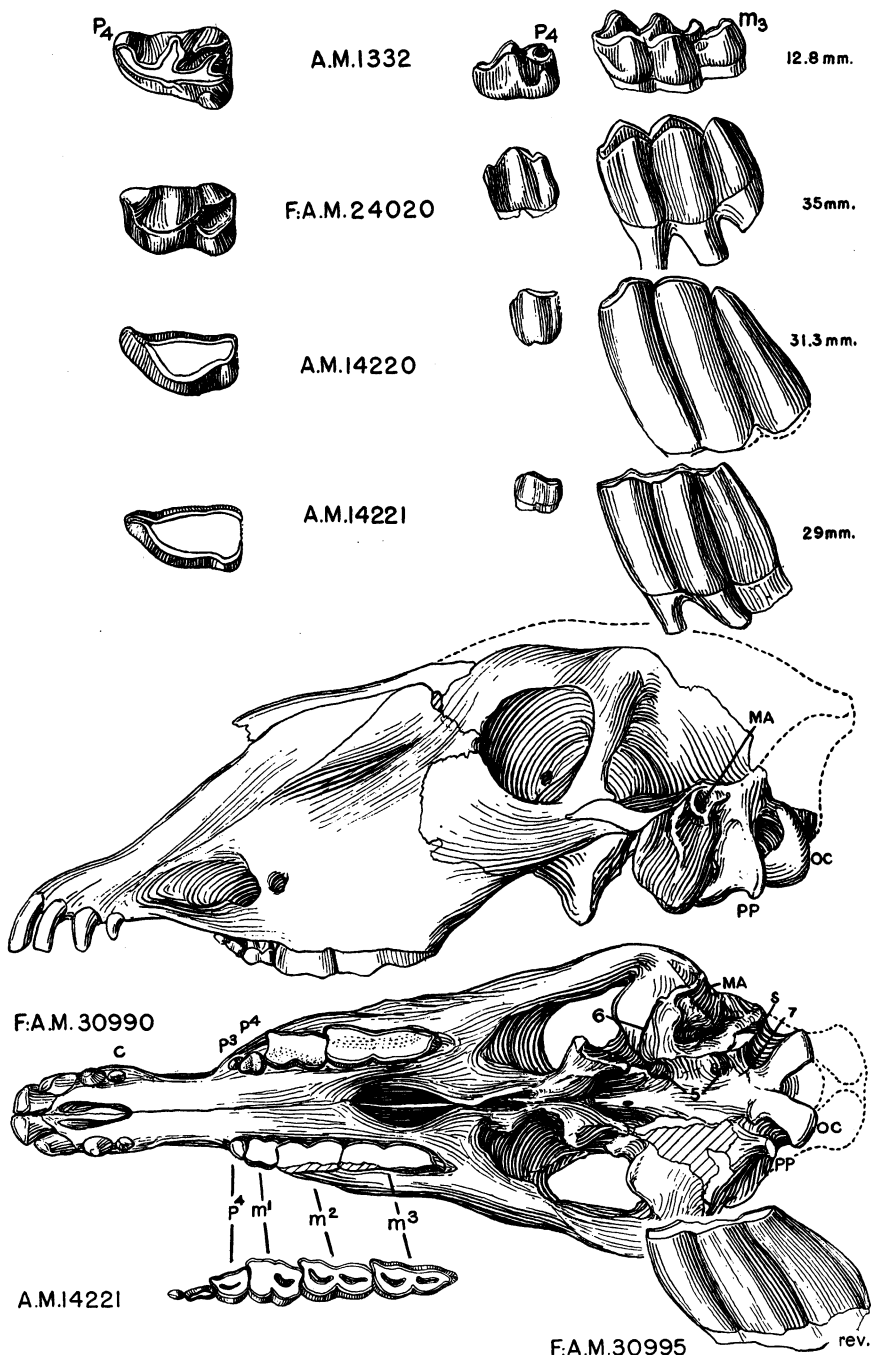


FIG. 67. *Rakomylus raki*, n.g. and sp., genotype (F:A.M.30990), from the Late Tertiary, north of White Operation, New Mexico.

$\times \frac{1}{2}$. (See page 657.) (For comparison and abbreviations, see Fig. 2A.)

Scaled p_4 and m_3 (continuation of Fig. 2B). *Leptomeryx* (A.M.1332), camelid (F:A.M.24020), *Stenomylus* (A.M.14220 and 14221) and *Rakomylus* (F:A.M.30995, rev., 39 mm.) species.

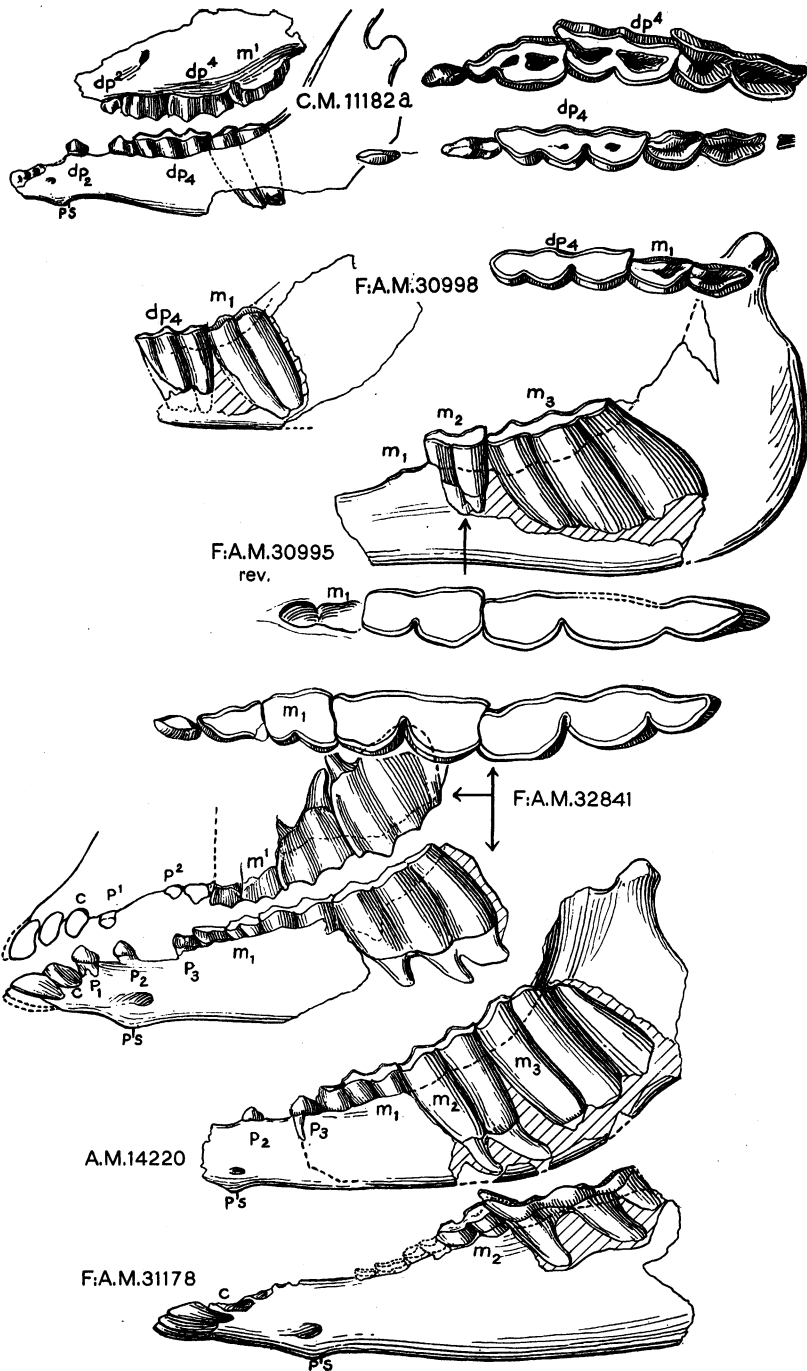


FIG. 68. *Rakomylus*, n.g., from the Late Tertiary of New Mexico (F:A.M. 30998 and 30995) and *Stenomylus* Peterson, from the Middle Tertiary of Nebraska and Wyoming, mandibular and maxillary dentitions compared.

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. (See legend, next page.)

DIVISION B.—STENOMYLINI

Subfamily 2.—*Stenomylinæ*

II. *RAKOMYLUS*, NEW GENUS

III. *STENOMYLUS* PETERSON

Figures 68 and (in part) 67

Statement

The strongly hypsodont and most surprising *Rakomylus*, n.g., of the Late Tertiary, *Stenomylus* Peterson of the Middle Tertiary and diminutive *Hypisodus* Cope of the Middle Tertiary exhibit different states of anteroposterior elongation of the molars and reduction of the premolars. The maximum expansion of m_3 and reduction of the premolars is attained in the remarkable genus, *Rakomylus*, here first described. Points of agreement between *Stenomylus* and *Hypisodus* have been noted by previous authors. The Stenomylini (Figs. 67, 68) represent the extreme in cheek-tooth specialization in the Camelidæ, which differs from the families, Cervidæ, Antilocapridæ and Bovidæ, in embracing in its membership subhypsodont as well as a large range of variable hypsodont forms. The *Rakomylus* m_3 , in height and expansion of the crown relative to the anterior teeth, exceeds any here-described Antilocaprid or Bovid. While, so far as observable, a Middle Tertiary *Bouromeryx* may have lain near the ancestral line of the Late Tertiary Barbouromerycinæ and Dromomerycinæ, and a Late Tertiary *Paratoceras* may have been descended from a Middle Tertiary *Protoceras* (*Synthetoceras* from *Pro-synthetoceras* and that Late Tertiary form from an early Middle Tertiary *Syndyoceras*), the relatively better-documented evidence in the case of the Stenomylinæ almost points to *Rakomylus* as a direct and more highly specialized descendant of *Stenomylus*.

FIG. 68. *Rakomylus*, n.g., from the Late Tertiary of New Mexico, and *Stenomylus* Peterson, from the Middle Tertiary of Nebraska and Wyoming, mandibular and maxillary dentitions compared. (See pages 658, 660-662.)

Lateral views $\times \frac{1}{2}$, occlusal $\times 1$. PS, posterior border symphysis.

C.M.11182a, *Stenomylus gracilis* Peterson (or *S. hitchcocki* Loomis), ?ref., from the Lower Harrison, Sioux County, Nebraska.

F:A.M.30998 and 30995 (rev.), *Rakomylus raki*, n.g. and sp., ref. (vertical ramus supplied from 30997), from Santa Fé area, New Mexico. (See also Fig. 67 [F:A.M. 30995].)

F:A.M.32841, *Stenomylus gracilis*, var., from Lusk, Wyoming. (Is/-p³ restored from A.M.14220.)

A.M.14220 [= 14220A and B combined], *Stenomylus crassipes* Loomis, ref., from the Lower Harrison, Sioux County, Nebraska. (See also Fig. 67.)

F:A.M.31178, *Stenomylus gracilis* Peterson, ref., from the Lower Harrison, Sioux County, Nebraska.

II. RAKOMYLUS, NEW GENUS

Total available listed specimens, 7

(1) *Rakomylus raki*, new genus and species

From the Tertiary of Santa Fé, New Mexico

The genus is remarkable for the peculiar character of muzzle and dentition. The skull, while of the general aspect and size of *Stenomylus*, is stouter and differs very markedly in the development of the premaxillary-nasal area, the enlarged central incisors, the longer post-C/ diastema, the enlargement of posterior molars and abortion to loss of premolars, the elongation of the ascending premaxillary branches, shortness of the nasals and depth of the anteromaxillary fossæ. The latter are suggestive of a proboscis-like development of the upper lip. I^1 and I^2 are very large; the smallness of C/ indicates a female; (p^1 - p^2 were never present); p^3 is diminutive peg-like and p^4 and m^1 rudimentary relative to the greatly enlarged m^2 - m^3 . The inferior area of the skull, pterygoids, glenoids, bullæ and condyles resemble *Stenomylus*. Noteworthy characters of the mandible are the abbreviation of the diastema, the apparent absence, in the aged series, of all of the premolars, the retention of the dp_4 in immaturity and the extraordinary expansion of the last lobes of the tall-crowned m_3 . The mandibular ramus narrows sharply anteriorly, as is usual in the camel, but the mandibular angle is rounded and without hook (inner muscular depression prominent) and the condyle is low. An exaggerated *Stenomylus* is seen in the proportions of m_3 relative to m_1 , the height of the m_3 crown and great width of its second and third lobes as compared to the first. The diastema immediately anterior to m_1 , as shown in two of the best preserved specimens, together with the brevity of the postsymphysial- m_1 distance, as shown in one specimen, tend to indicate the entire absence of p_4 . The dp_4 , relative to m_1 (and m_3), is proportionately small as compared to the condition in *Stenomylus* (see Fig. 68). The limbs, as seen in metacarpi, were short-proportioned.

The genus is named in memory of Joseph Rak, who in years past collected its first observed remains from Santa Fé exposures. The only so-far-known skull was discovered the present summer in the same area by the John C. Blick party.

GENOTYPE.—Well-preserved skull, complete save for postero-superior cranium, with Is/, C/ and p^2 - m^3 . (Left m^1 and right p^3 are shed.)

(w+) F:A.M.
Fig. 67 30990

	<i>Rakomylus raki</i>	<i>Stenomylus crassipes</i>
	Genotype	Referred
	F:A.M.30990	A.M.14221
B.L.....	= 200 mm.	197 mm.
Post C/-p ³ diastema...	= 29	22
p ³ -p ⁴	= (10)	18
m ¹ -m ²	= (53.5)	54.5
m ³	= (28.5)	21.5

REFERRED.—

Left and apparently associated right partial mandibular rami with portion of diastema, m ₁ alveolus and m ₂ -m ₃ . (Collected by Joseph Rak, north of Santa Fé.).....	(w+)	1918	F:A.M. 30995
	Figs. 67, 68		

	<i>Rakomylus raki</i>	<i>Stenomylus crassipes</i>
	F:A.M.30995	A.M.14220
m ₁ alveolus.....	= ((8)) mm.	15.7 mm.
m ₂	= 16+	(23)
m ₃	= 34+	28.5

Section of right ramus with portion of diastema, indication of posterior border of symphysis and m ₁ alveolus-m ₃	(w+)		30996
Right posterior ramus showing rounded angle, low-lying condyle and m ₃	(w)	1933	30997
Left fragment with dp ₄ -m ₁ (erupting).....	Fig. 68	1928	30998

Two small and unique metacarpi (F:A.M.30999 and A, length approximately 135 mm.), one of which was collected in the immediate vicinity of one of the above mandibular specimens, are referred to the genus. While the two specimens represent the smallest camelid-formed metacarpi from the Santa Fé area known to the writer, they are not disproportionately small for the type skull, their lengths being equivalent to the distance from the incisive border to opposite the anterior third of the orbit.

III. STENOMYLUS PETERSON

From the Middle Tertiary of Nebraska and Wyoming

The peculiarly specialized genus *Stenomylus* of the Middle Miocene represents an aberrant side-branch of the Camelidæ. The genus is interesting, as noted above, in connection with the somewhat similarly but more specialized *Rakomylus*, n.g., of the New Mexican Late Tertiary. Peterson (1907) remarks on the resemblance of *Stenomylus* and *Hypisodus*. Consideration of *Stenomylus* here is confined to a relisting of the types and a few referred remains of the several described species and the recording of minor new evidence from Nebraska and Wyoming.

The description by Peterson of the genotypic species, *S. gracilis*, based on remains from the vicinity of the Niobrara, was followed by a discussion by Loomis (1910) of remains from the Amherst Quarry, where a great series of these little camelids has been obtained by several institutions. A reëxamination of the fossil evidence as a whole is much to be desired, as the same should throw light on individual variation within the group and on the status of the three named species.

Heretofore undescribed specimens include: a fragmentary mandible and associated radius (F:A.M.31178, Fig. 68), obtained by Paul Miller (1927) from the vicinity of the Niobrara, of an individual of fully as large size as the *S. gracilis* type; and remains, collected near Lusk by Charles Falkenbach and east of Rawhide Buttes, Wyoming, by Paul Miller, which include a smaller variation ostensibly equivalent to that of the remains from the Amherst Quarry. Several of these newly secured specimens are figured on the adjoining plate in comparison with teeth of *Rakomylus*. A specimen of the deciduous dentition (C.M.11182a), figured through the kindness of Director Avinoff of the Carnegie Museum, shows the dp_2 widely detached and dp_3 much reduced.

Characters.—Three Is/ and C/ in series, slight diastema, p^1 small, double-rooted, p^2 greatly reduced (actually smaller than p^1), p^3 small and tending to be slightly separated from p^2 ; three /Is, incisiform-tending /C and p_1 in series, moderate diastema, p_2 double-rooted (lying halfway between p_1 and p_3 and posterior to the mental foramen), p_3 greatly reduced and approximating p_2 , the anteroposterior diameter of the molar lobes consecutively increasing from m_1^1 – m_3^3 ; horizontal ramus depth rapidly decreasing from angle to symphysis, typical camelid hook absent; posterior nares opposite posterior edge of m^1 , no formed sagittal crest; fourth cervical longest, fifth cervical next to longest; metacarpus consolidated. (See table of measurements, page 663.)

Summary of Named Species

The genus is exemplified by:

- (1) *Stenomylus gracilis* Peterson, genotypic species, from the Niobrara, Nebraska.

GENOTYPE.—Base of skull, mandible, certain limbs and vertebræ, C.M. 1610.

- (1a) *Stenomylus gracilis*, var., from vicinity of Lusk, Wyoming.

EXAMPLE.—Partial cranium and ramus, F:A.M.32841. This paper, Fig. 68.

- (2) *Stenomylus crassipes* Loomis, from Amherst Quarry near Agate Spring post office, Nebraska.

TYPE.—Skull, mandible and skeletal elements, Amh.Coll.2150.

- (3) *Stenomylus hitchcocki* Loomis, from Amherst Quarry ("slightly higher level").

TYPE.—Articulated female skeleton, Amh.Coll.2059.

Detailed Lists of Types, Certain Specimens, and Synonymy

Stenomylus, total available specimens, 43; total listed, 17; unlisted, 26.

(1) *Stenomylus gracilis* Peterson, genotypic species

From the Lower Harrison Beds, Sioux County, Nebraska

Stenomylus gracilis PETERSON, 1906-08, Ann. Carn. Mus., IV (1907), pp. 35, 41, Pl. XII, Text-Fig. 9; (1908), p. 286, Text-Figs. 1-12. LOOMIS, 1910, Amer. Journ. Sci. (4), XXIX, p. 318; 1911, *ibid.* (4), XXXI, p. 70.

GENOTYPE.—Base of skull with p^2 - m^3 , mandible with complete dentition and certain limbs and vertebrae.

C.M.1610

Collected in the vicinity of the Niobrara River, 1901. Figured by Peterson, 1907, Pl. XII.

p_2^2 greatly reduced.

Length upper series = (82) mm. (sum of tooth lengths).

Length metatarsus = 192

Length radius = 220

(See measurement table.)

REFERRED, SECURED IN THE GENERAL VICINITY BY PAUL MILLER, 1927.—

Mandibular portions including left ramus with three /Is, alveoli of /C and p_1 and ?trace of p_2 alveolus, m_2 - m_3 greatly worn, and right ramus with m_2 - m_3 . (w+++)

F:A.M.31178

This paper, Fig. 68.

Length radius = 229 mm.

QUESTIONABLY REFERRED (possibly *S. hitchcocki* Loomis).—

Fragmentary palate and C.M.11182a This paper, *Fig. 68*.
 both rami exhibiting dp_2^1 -
 m_1^1 (erupting).

According to Loomis, the species is rather rare, larger than *S. hitchcocki*, with the metacarpals partially united, the upper molars narrower, the /C less incisiform and the p_1 - p_2 diastema shorter.

(1a) *Stenomylus gracilis*, Var.

From the Vicinity of Lusk, Wyoming

EXAMPLE.—Partial cranium F:A.M.32841 Collected by Charles Falken-
 with p^4 - m^3 and ramus bach, 1931, from E. side of
 with I_1 - m_3 . (w+) road to Jay Em.
 This paper, *Fig. 68*.

REFERRED.—

Right ramus with p_2 al- F:A.M.32842 From E. side of road to Jay
 veolus and p_3 (br.)- m_3 . Em, 1931.
 Portions of skull including F:A.M.32840 Collected by Paul Miller, E.
 I_3 / and p^2 - m^3 (erupting). of Raw Hide Butte, 1927.

Slightly smaller:

Anterior portion of man- F:A.M.32843 From E. side of road to Jay
 dible with I_1 - m_2 . (w+) Em, 1931.
 Left p_1 alveolus- m_3 . F:A.M.32845 From N. of Keeline, 1931.

Smaller, approximating *S. crassipes* in size:

Right ramus with p_1 - m_3 . F:A.M.32844 From near No. 85, 1932.
 (w++)
 Left ramus with p_3 (br.)- F:A.M.32846 From N. of Keeline, 1931.
 m_3 . (w+)

(2) *Stenomylus crassipes* Loomis

From the Lower Harrison Beds, Sioux County, Nebraska

Stenomylus crassipes LOOMIS, 1910, Amer. Journ. Sci. (4), XXIX, p. 319, Text-Figs. 27-30; 1911, *ibid.* (4), XXXI, p. 70.

- TYPE.—Skull lacking premaxilla, mandible, six cervical and three dorsal vertebrae, scapula, humerus, ulno-radius, carpals, metacarpals and phalanges. Amh. Coll. 2150 Figured by Loomis, 1910, Text-Figs. 27-30.

REFERRED.—

- Left ramus with p_1-m_3 (erupting). A.M. 14220A This paper, Figs. 67, 68.
Loomis' "cotype."
Left ramus with p_2 , diastema and p_3 (br.)- m_3 (erupting). A.M. 14220B
Skull, mandible and partial skeleton. A.M. 14221 This paper, Fig. 67.
Catalogued under *Stenomylus gracilis* Peterson.
Skull and mandible. (-m) A.M. 14220
Right maxilla with p^4-m^3 . A.M. 14220
(w)
Immature maxilla-premaxilla with Is /, Cs / and p^1 . A.M. 14220

According to Loomis, the general size of the skull approximates *S. gracilis*, but the neck and limbs shorter and heavier, the premolars much more reduced and the /C completely incisiform.

(3) *Stenomylus hitchcocki* Loomis¹

From the Lower Harrison Beds, Sioux County, Nebraska

Stenomylus new species LOOMIS, 1909, Science, N.S., XXIX, p. 196.

Stenomylus hitchcocki LOOMIS, 1910, Amer. Journ. Sci. (4), XXIX, pp. 298, 318, Figs. 1-26; 1911, *ibid.* (4), XXXI, p. 70. PETERSON, 1911, Ann. Carn. Mus., VII, p. 267, Pl. XLIV; 1912, *ibid.*, VIII, p. 366, Pls. XXI, XXII.

According to Loomis, secured from a higher level of the Lower Harrison than *S. crassipes*.

¹Two Carnegie Museum specimens credited to *S. tyleri* Loomis; 1909, Ann. Carn. Mus., V, p. 453.

TYPE.—Articulated skeleton, Amh.Coll.2059 From Amherst Quarry, 5 miles S.E. of Agate Spring post office.
♀. (M) Figured by Loomis, 1910, Fig. 1.

(Loomis estimates height at shoulder = 27 inches [684 mm.].)

REFERRED.—

Six skulls, twelve jaws and four disarticulated skeletons in the Amherst Collection, and "four skeletons" in the American Museum Collection. (Loomis, 1910.)

The three composite skeletons (figured, 1912, Pls. XXI, XXII, Ann. Carn. Mus., VIII) representing male, female and immature, Carnegie Museum mounts, and the large series of composite skeletons of the American Museum's mounted group have been referred to this species.

According to Loomis, this species is the least specialized and commonest of the three forms, and is distinguished by small size, metacarpals entirely separate, molars narrow, /C completely caniniform, p_1 - p_2 diastema relatively long and the p_2 greatly reduced.

MEASUREMENTS

[Millimeters]

	<i>Stenomylus gracilis</i> Peterson	<i>Stenomylus crassipes</i> Loomis		<i>Stenomylus hitchcocki</i> Loomis	
	Genotype C.M.1610	Type *A.C.2150	Ref. A.M.14220	Type *A.C.2059	Ref. A.M.14224
B.L.....			(?)204	(?)175	(165)
I/-occ. condyle.....		211		166	
p^2 - m^3	(82)	78(M)	79(-M)	60.5(-M)	(?)64
p^1 - m^3			(75)(-M)		
Radius.....	220	194	215	191	
Metacarpus..	182	166	* 170	158.5	144
Tibia.....	242		*213	210	
Metatarsus...	192		*185	166	155

* From Loomis, 1910.

() approximate measurement.

INDEX OF GENERA AND SUBGENERA

MENTIONED IN THIS VOLUME

Page numbers starred = citation of genotype; page numbers *italicized* = genus cited in figure legends (and text); page numbers *italicized* and in () = genus cited in figure captions; page numbers in **boldface type** = discussion of genus.

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